ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

DIFFERENT TREATMENT MODALITIES FOR PARASYMPHYSIS FRACTURES- A COMPARATIVE EVALUATION

Thesis submitted to

DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY, SPPGIDMS

BY

DR. ABHISHEK SINGH

Under The Guidance of

DR. GAURAV SINGH

Co- Supervisors

DR. MADAN MISHRA

DR. AMIT GAUR

DR. BHARAT SHUKLA

Dr .Ram Manohar Lohia Avadh University,

Faizabad (U.P.)

ACKNOWLEDGEMENT

"Hard work beats talent when
Talent doesn't work hard"

First and foremost, I pray to ***God the Almighty Creator*** *without whose benevolent blessing nothing is possible and with whose grace I could accomplish my duty.*

I express my respect and deepest sense of gratitude to my guide ***Dr. Gaurav Singh*** *Professor, Department of Oral and maxillofacial surgery, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, for his constant support, positive attitude, unmatched enthusiasm and blessings. Through his immense power of motivation, innovative ideas, aim for perfection, tremendous sense of discipline and academic excellence he made me bring out the best in me. His support and encouragement in bringing this dissertation to a successful completion. His unstinted support, constructive counselling and total emphasis on preciseness have brought this work of mine to its present form.*

It is with great privilege that I thank ***Maj. Gen Dr. Mahesh Chander (Retd.),*** *Professor and Head, Department of , Oral and maxillofacial surgery, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, for rendering me unsurmountable support and innumerable scientifically important contributions while improving my work systematically. I am grateful to him for his academically precious suggestions and constructive guidance during my journey of preparing this dissertation.*

I express my gratitude to ***Dr. Anurag Yadav****, Reader, Department of, Oral and Maxillofacial Surgery Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, for his efficient supervision and valuable suggestions at all times. His wisdom, knowledge and commitment to the highest standards inspired and motivated me. I shall always remember him as my academic mentor because of his perseverance and practical help throughout the whole period of my project work.*

It is with deep sense of gratitude and heartfelt appreciation, that I thank my esteemed teacher and Co-guide ***Dr. Amit Gaur****, Reader, Department of Oral and maxillofacial surgery Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, for his invaluable guidance, support and encouragement in bringing this dissertation to a successful completion. His unstinted support, constructive counselling and total emphasis on preciseness have brought this work of mine to its present form.*

I express my gratitude to ***Dr. Madan Mishra,*** *Reader, Department of, Oral and maxillofacial surgery Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, for his efficient supervision and valuable suggestions at all times. His wisdom, knowledge and commitment to the highest standards inspired and motivated me. I shall always remember him as my academic mentor because of his perseverance and practical help throughout the whole period of my project work.*

I owe a very special note of gratitude to ***Dr. Sharad Chand,*** *senior lecturer, Department of Oral and maxillofacial surgery, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow. I regard her as the fountain head of all that gives light of academic knowledge and power and also constructive guidance over my tough journey of preparing this dissertation.*

I express my profound respect and gratitude to ***Dr. Shishir Dhar,*** *Senior lecturer, Department of Oral and maxillofacial surgery, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, for her practical suggestions which has guided me in moulding this work to its present form.*

It gives me great pleasure to express many thanks and gratitude to ***Dr. Shubhamoay Mondal,*** *Senior Lecturer, Department of Oral and maxillofacial surgery, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, who extended their valuable help and guidance, moral support and academic suggestions at various stages during the preparation of the present work.*

I would like to express my gratitude to my seniors ***Dr.Harmurti Singh, Dr. Gauravi Gupta, Dr. Abhinav Srivastava, Dr. Sumit Verma and Dr. Sardar Singh Yadav*** *beloved colleagues* ***Dr. Abhigyan Manas, Dr. Mohammad Shaqib, Dr. Shailesh Kumar, Dr. Sapna Tandon*** *and my dear juniors* ***Dr. Bharat Shukla, Dr. Gourab Das, Dr. Praroop Mehta, Dr. Kiran Kumari, Dr. Ajay Kushwaha, Dr. Bharat Vashisth, Dr. George Jacob, Dr. Akshay Kumar, Dr. Ajita Dwivedi, Dr. Mohammad Nouman*** *along with department attendants* ***Prem, Babita Sister & Chanchlesh*** *for their liberal help and support to this effort.*

My due thanks to ***Mr. Varun*** *for doing the statistical analysis and* ***Mr. Kailash*** *for extending his support and helping me to complete my dissertation.*

Gratitude cannot be seen but only felt; therefore the heartfelt feelings cannot always be described easily. Nevertheless I wish to salute with soul felt esteem and reverence to my loving parents ***Mr. Shyam Narayan Singh and Mrs. Durgawati Devi,*** *my uncle* ***Mr. Hari Narayan Singh*** *and my aunty* ***Mrs. Pushpa Devi,*** *my sister* ***Rinki, Suman, Sarika*** *,my brothers* ***Mr. Pradeep, Mr. Bhupesh and Mr. Atul*** *and to my family.*

-Dr. Abhishek Singh

CONTENTS

****

LIST OF FIGURES

23	Post-operative OPG after 6 months
	GROUP-III (PRE-OPERATIVE PHOTOGRAPH)
24	Extraoral view
25	Intraoral view
26	Orthopantomogram (OPG)
	OPERATIVE PROCEDURE
27	Intra-oral incision
28	Exposure of fracture site
29	Miniplate fixation at fracture site using 2 mm system
30	Intraoral closure using 3-0 vicryl
	POST-OPERATIVE
31	Extra oral view
32	Intra oral view
33	Immediate post-operative OPG
34	Post-operative OPG after 6 months

LIST OF TABLES

LIST OF GRAPHS

INTRODUCTION

The incidence of mandibular fracture in day to day Oral and Maxillofacial practice is quite high. Among various types of mandibular fractures, incidence of parasymphysis fracture is about 13%. The management of mandibular fractures has undergone various changes right from 17th century BC till today. These techniques has ranged from closed reduction with maxillomandibular fixation (MMF), to open reduction with wire osteosynthesis or rigid internal fixation or miniplate fixation. The introduction of bone plates as the implants for osteosynthesis has changed the facet of oral and maxillofacial surgery. The concept of bone plating has changed over time, with the introduction of various modifications. Bone plates such as microplates, miniplates, reconstruction plate, compression plates, dynamic compression plates, eccentric dynamic compression plates, have been introduced, but miniplates are the ones most commonly used.[1,2]

The fixation of mandibular fractures has been an evolutionary process that over time has visited many different concepts. As with other surgical advances, the modalities for treatment of mandibular parasymphysis fractures have evolved, based on the patient's need and the most recent scientific advances[3]. The lag screw technique was first introduced to maxillofacial surgery by Brons and Boering in 1970, who cautioned that at least 2 screws are necessary to prevent rotational movements of the fragements in oblique

fractures of the mandible.[4] During the early 1970s, Schmoker and Spiessl developed dynamic compression plating for the mandible, which used eccentrically placed screws to generate compression[5]. That form of stabilization was provided by the compression of the bony surface by plating device. It creates and maintains frictional resistance between the fractured bone ends, thereby gaining more stability than the use of plate alone. Others began to advocate that a 2-point fixation technique should be used to maintain proper occlusion and to prevent the twisting of the inferior border. Miniplate osteosynthesis, first introduced by Michelet in 1973 and further developed by Champy in 1975, is today's standard for the treatment of mandibular fractures. With this surgical technique, two miniplates are applied in the interforaminal region. In 1973, Michelet et al described the treatment of mandibular fractures using small, easily bendable, non-compression miniplates placed transorally and anchored with monocortical screws.

In 1970 Champy et al determined the ideal line of osteosynthesis in the mandible, where they suggested that miniplate fixation is most stable[6]. According to Champy, tensile forces exist at the superior border of the mandible and compressive forces at its inferior border. In the parasymphysis region, another line is drawn near the lower border to neutralize the tension forces; as torsional forces in the parasymphysis region are high[7-8]. The principle of osteosynthesis, according to Champy, is to re-establish the mechanical qualities of the mandible[9]. Champy advised the use of two

miniplates in the anterior region[10], one at the inferior border and the second 5 mm above the lower plate. This Champy's principle is still followed, but the need for two miniplates in the parasymphysis region is questioned, when a lower arch bar is also placed simultaneously for intra or postoperative maxillo-mandibular fixation. Though Champy did not use arch bars for intra-operative inter-maxillary fixation, most surgeon use arch bars either for intra-operative or post-operative inter-maxillary fixation itself acts as a tension band and sub-apical plate (tension band plate) can be eliminated. Since a single miniplate is used instead of two plates it will be economical for the patients, reduce the incidence of mental nerve injury and will reduce injury to the roots of the anterior teeth and reduce wound dehiscence.[11,12]

In this study, three different modalities for treating isolated displaced mandibular parasymphysis fracture are compared. The objectives of the study is to compare three different treatment modalities clinically and radiographically by assessing, discrepancy in the occlusion, anaesthesia or paraesthesia due to mental nerve injury, evidence of infection at the operated site, exposure of osteosynthesis implants, intra-operative time taken for the procedure, lower border mal-alignment, loosening of screws or plates, and improper reduction of fracture fragment.[1]

AIM AND OBJECTIVES

AIM

To compare the stability and efficacy of different treatment modalities for management of parasymphysis fracture.

OBJECTIVES

The objective of the study was to evaluate and compare the treatment outcome of three different modalities in the management of parasymphysis fracture, using various parameters.

MATERIAL AND METHODS

The present study was conducted on patients of mandibular parasymphysis fracture attending the out patient department of oral and maxillofacial surgery in SPPGIDMS LUCKNOW, with permission from ethical committee. All patients were undergone clinical, radiographic and routine blood investigations, before surgery. Patients were selected randomly irrespective of age, sex, caste, and creed.

SAMPLE SIZE:

Minimum 30 patients were selected for this study, 10 in each group (Group I, II, III).

- **Group I –** Two mini plates will be placed across the fracture site along with Erich's arch bar for six weeks.
- **Group II-** Two mini plates will be placed without Erich's arch bar.
- **Group III-** One mini plate will be placed along with the Erich's arch bar for six weeks.

SELECTION CRITERIA:

Inclusion criteria:

- Isolated parasymphysis fracture with occlusal discrepancy.
- No sign of mental nerve injury.

EXCLUSION CRITERIA:

- Patients with edentulous mandible.
- Parasymphysis fracture associated with other mandibular or facial bone fracture.
- Patients unwilling to undergo open reduction and internal fixation.
- Severely comminuted and infected fracture.
- Patients not fit to undergo procedure under general anaesthesia (ASA III-VI).

WITHDRAWAL CRITERIA:

- Patients not returning for check-up, follow up or documentation.
- Patients not following post-operative instructions.

RADIOGRAPHIC ASSESSMENT:

Following radiographs shall be taken to assess post-operative result

- Orthopantomogram (OPG)

- Postero-anterior view of mandible (P A view)
- Computed tomography scan (optional)

SURGICAL PROCEDURE:

Patients were operated either under general anaesthesia or local anaesthesia. Strict asepsis was followed. The fracture site was exposed through an intraoral incision. Mucosal incision was given approximately 5 mm below the attached gingiva. Mucoperiosteal flap was reflected and fracture site was exposed. Mobile teeth, fractured teeth, and teeth with apices exposed in the fracture site was removed. The fracture was reduced and the jaws were placed into maxillo-mandibular fixation (MMF). The plate were placed along the ideal lines of osteosynthesis as described by Champy et al. In Group 1, straight miniplate as lower plate was adapted at the lower border keeping at least two holes on each side of fracture line. Holes were drilled using drill bit along with copious saline irrigation to prevent damage to the bone by heat. Screws were tightened in drilled hole. Similarly upper miniplate was fixed approximately 4-5 mm above the lower plate. In Group 2, straight miniplate were fixed in same manner as Group 1 but without arch bar. In Group 3, single miniplate was fixed at the lower border of the mandible with arch bar. After the plates were placed, MMF was released and occlusion was checked. The intraoral incision was closed with resorbable sutures. All patient's were put on MMF with elastics for 2 weeks postoperatively. Patients will be reviewed at immediate post-

operative period, 15th day, 1stmonth, 3rd month and 6th month post-operatively. MMF was released 2 weeks after surgery, and arch bars was removed after the fourth post-surgical week. Patients in all 3 groups were given antibiotics and analgesics postoperatively.

Postoperative care

- Postoperatively intravenous antibiotics (Ceftriaxone 1gm BD, Metronidazole100 ml TDS) and anti-inflammatory (Diclofenac sodium TDS) drugs were continued for 5 days postoperatively.
- Patients were advised to maintain oral hygiene by rinsing with 0.2% Chlorhexidine gluconate.
- Patients were advised strictly liquid diet.

Criteria of assessment

1: Loosening of screws or plates [Present (+), Absent (-)]

Time period	Group 1	Group 2	Group 3
Immediate postoperative period 15 days 1 month 3 months 6 months			

2: Inferior border malalignment [Present (+), Absent (-)]

Time period	Group 1	Group 2	Group 3
Immediate postoperative period 15 days 1 month 3 months 6 months			

3: Improper reduction of fractured segments [Present (+), Absent (-)]

Time Period	Group 1	Group 2	Group 3
Immediate postoperative period 15 days 1 month 3 months 6 months			

4: Signs/symptoms of paraesthesia [Present (+), Absent (-)]

Time Period	Group 1	Group 2	Group 3
Immediate postoperative period 15 days 1 month 3 months 6 months			

5: Occlusal discrepancy [Present (+), Absent (-)]

Time Period	Group 1	Group 2	Group 3
Immediate postoperative period 15 days 1 month 3 months 6 months			

6: Exposure of implant [Present (+), Absent (-)]

Time Period	Group 1	Group 2	Group 3
Immediate postoperative period 15 days 1 month 3 months 6 months			

7: Evidence of infection/would dehiscence [Present (+), Absent (-)]

Time Period	Group 1	Group 2	Group 3
Immediate postoperative period 15 days 1 month 3 months 6 months			

8: Intra operative time taken for the procedure.

S. No. Of patient	Group 1	Group 2	Group 3

STATISTICAL ANALYSIS

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. The values were represented in Number (%) and Mean±SD.

The following Statistical formulas were used:

1. **Mean**: To obtain the mean, the individual observations were first added together and then divided by the number of observation. The operation of adding together or summation is denoted by the sign Σ.

   The individual observation is denoted by the sign X, number of observation denoted by n, and the mean by $\overline{X}$.

$$\overline{X} = \frac{\Sigma X}{\text{No. of observations (n)}}$$

2. **Standard Deviation**: It is denoted by the Greek letter σ. If a sample is more than 30 then.

$$\sigma = \sqrt{\frac{\Sigma(X - \overline{X})^2}{n}}$$

When sample in less than 30 then.

$$\sigma = \sqrt{\frac{\Sigma(X - \overline{X})^2}{n-1}}$$

3. **Median:** To determine the median value in a sequence of numbers, the numbers must first be arranged in value order from lowest to highest. If there is an odd amount of numbers, the median value is the number that is in the middle, with the same amount of numbers below and above. If there is an even amount of numbers in the list, the middle pair must be determined, added together and divided by two to find the median value. The median can be used to determine an approximate average.

4. **Chi square test:**

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where O = Observed frequency

E = Expected frequency

5. **Analysis of Variance: Analysis of Variance** (ANOVA): The ANOVA test was used to compare the within group and between group variances amongst the study groups *i.e.* the three different sealers. Analysis of variance of these three sealers at a particular time interval revealed the

differences amongst them. ANOVA provided “F" ratio, where a higher "F" value depicted a higher inter-group difference.

$$: F = \frac{\text{Mean of Sum of Between Group Differences}}{\text{Mean of Sum of within Group Differences}}$$

Differences	**Sum of Squares**	**df**	**Mean Square**	**F**
Between Groups	A	N_1	$X=A/N_1$	X/Y
Within Groups	B	N_2	$Y=B/N_2$	

6. Level of significance: "p" is level of significance

p> 0.05 Not significant

p <0.05 Significant

p <0.01 Highly significant

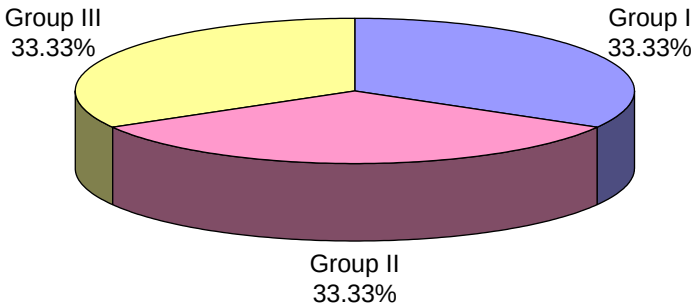
p <0.001 Very highly significant

RESULTS

The present study was conducted in the Department of Oral & Maxillofacial Surgery, Sardar Patel Institute of Dental & Medical Sciences, Lucknow to compare the stability and efficacy of different treatment modalities for management of parasymphysis fracture. All the patients of mandibular parasymphysis fracture attending the out patient department were enrolled in the study. Out of which 30 patients giving their consent to be included in the study were included in the study and were randomly selected in three groups as under (**Table 1, Graph 1**).

Table 1: Distribution of Study Population

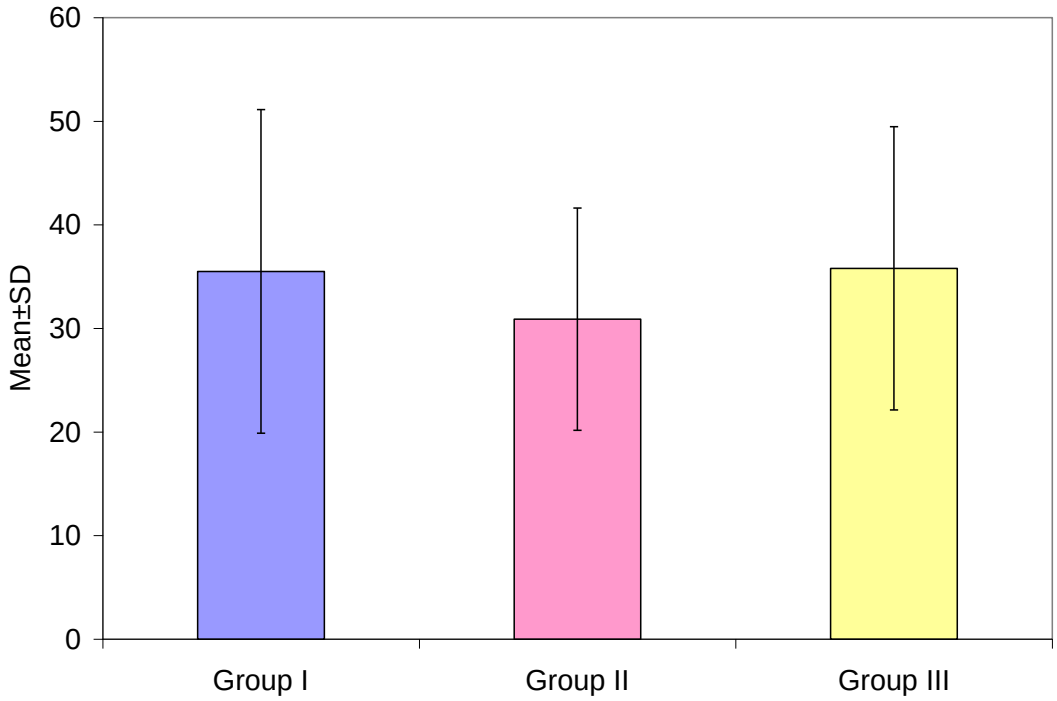
S. No.	Group	Description	No. of subjects	Percentage
1-	Group I	Two mini plates placed across the fracture site along with Erich's arch bar for six weeks	10	33.33
2-	Group II	Two mini plates placed without Erich's arch bar	10	33.33
3-	Group III	One mini plate placed along with the Erich's arch bar for six week	10	33.33
		Total	30	100.00



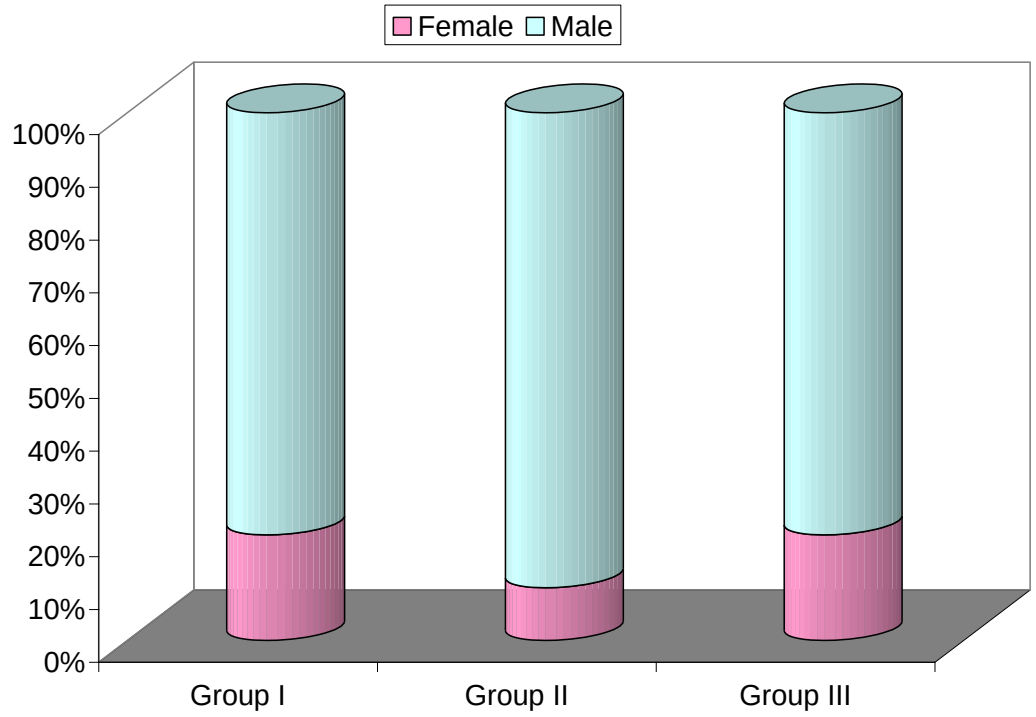
Graph 1: Distribution of Study Population

Table 2: Intergroup Comparison of Demographic Profile of Study Population

	Group I (n=10)		Group II (n=10)		Group III (n=10)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age in years (Range)	35.50	15.62	30.90	10.73	35.80	13.67
	18-65		18-50		18-61	
	F=0.415; p=0.665					
	No.	**%**	**No.**	**%**	**No.**	**%**
Gender						
Female	2	20.0	1	10.0	2	20.0
Male	8	80.0	9	90.0	8	80.0
	χ^2=0.480 (df=2); p=0.787					



Graph 2: Intergroup Comparison of Demographic Profile of Study Population (Age)



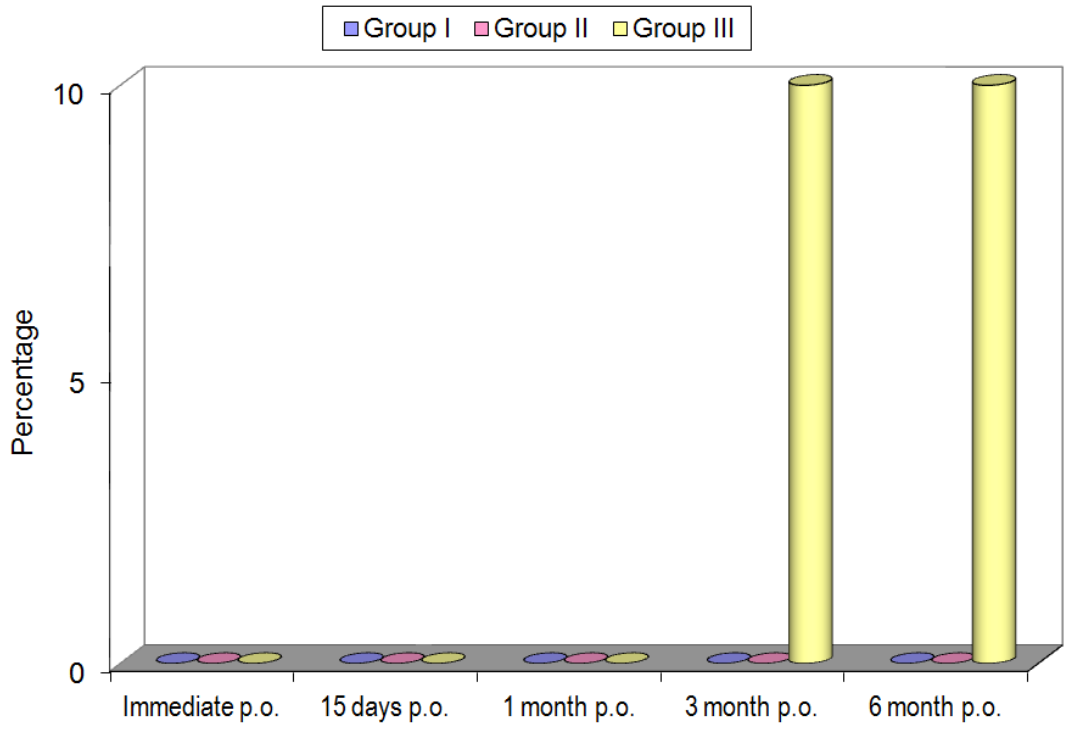
Graph 3: Intergroup Comparison of Demographic Profile of Study Population (Sex)

Age of patients ranged from 18-65 years in Group I, 18-50 years in Group II and 18-61 years in Group III. Difference in mean age of Group I (35.50+15.62 years), Group II (30.90+10.73 years) and Group III (35.80+13.67 years) was not found to be statistically significant (p=0.665) (**Table 2,Graph 2**).

In Group I and Group III, proportion of females (20.0%) was higher than that in Group II (10.0%) but this difference was not found to be statistically significant (p=0.787) (**Table 2, Graph 3**).

Table 3: Intergroup Comparison of incidence of Loosening of Screws/Plate in Study Population at different time intervals

Time Interval	Group I (n=10)		Group II (n=10)		Group III (n=10)		Statistical significance	
	No.	%	No.	%	No.	%	χ^2	P
Immediate p.o.	0	0.00	0	0.00	0	0.00	–	–
15 days p.o.	0	0.00	0	0.00	0	0.00	–	–
1 month p.o.	0	0.00	0	0.00	0	0.00	–	–
3 month p.o.	0	0.00	0	0.00	1	10.00	2.069	0.355
6 month p.o.	0	0.00	0	0.00	1	10.00	2.069	0.355



Graph 4: Intergroup Comparison of incidence of Loosening of Screws/Plate in Study Population at different time intervals

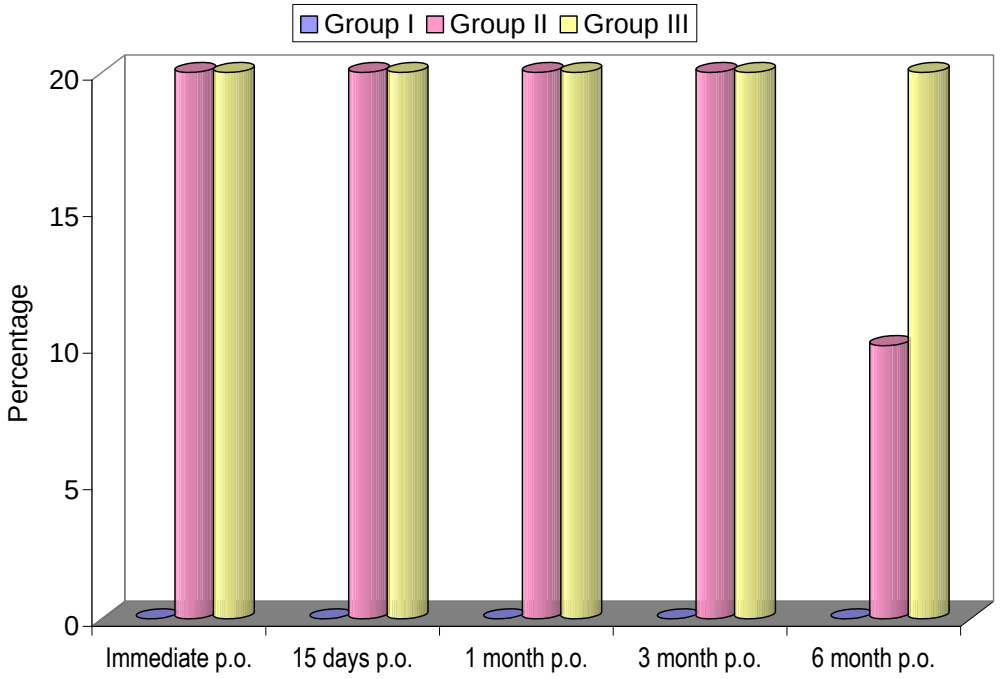
Loosening of screws/plates was not observed in any patients of Group I and Group II at any time period of follow up while loosening was observed in Group III at follow up at 3rd month and 6th month post-operatively.

No difference in incidence of loosening of screws among the groups was observed at immediate post-operatively, 15th day and 1st month post-operatively.

Though at 3rd month post-operatively and 6th month post-operatively, loosening of screws/plate was found in 1 (10.0%) patient of Group III as compared to none in Group I and Group II, difference in incidence of loosening of Screws/plate among the groups was not found to be statistically significant (p=0.355) (**Table 3, Graph 4**).

Table 4: Intergroup Comparison of incidence of Inferior Border Mal-alignment in Study Population at different time intervals

Time Interval	Group I (n=10)		Group II (n=10)		Group III (n=10)		Statistical significance	
	No.	%	No.	%	No.	%	χ^2	P
Immediate p.o.	0	0.00	2	20.00	2	20.00	2.308	0.315
15 days p.o.	0	0.00	2	20.00	2	20.00	2.308	0.315
1 month p.o.	0	0.00	2	20.00	2	20.00	2.308	0.315
3 month p.o.	0	0.00	2	20.00	2	20.00	2.308	0.315
6 month p.o.	0	0.00	1	10.00	2	20.00	2.222	0.329



Graph 5: Intergroup Comparison of incidence of Inferior Border Mal-alignment in Study Population at different time intervals

Immediately after the surgery inferior border malalignment was found in 2 (20.0%) patients of Group II, and 2 (20.0%) patients of Group III and none (0.0%) patients of Group I. Difference in incidence of inferior border malalignment among the groups was not found to be statistically significant (p=0.315).

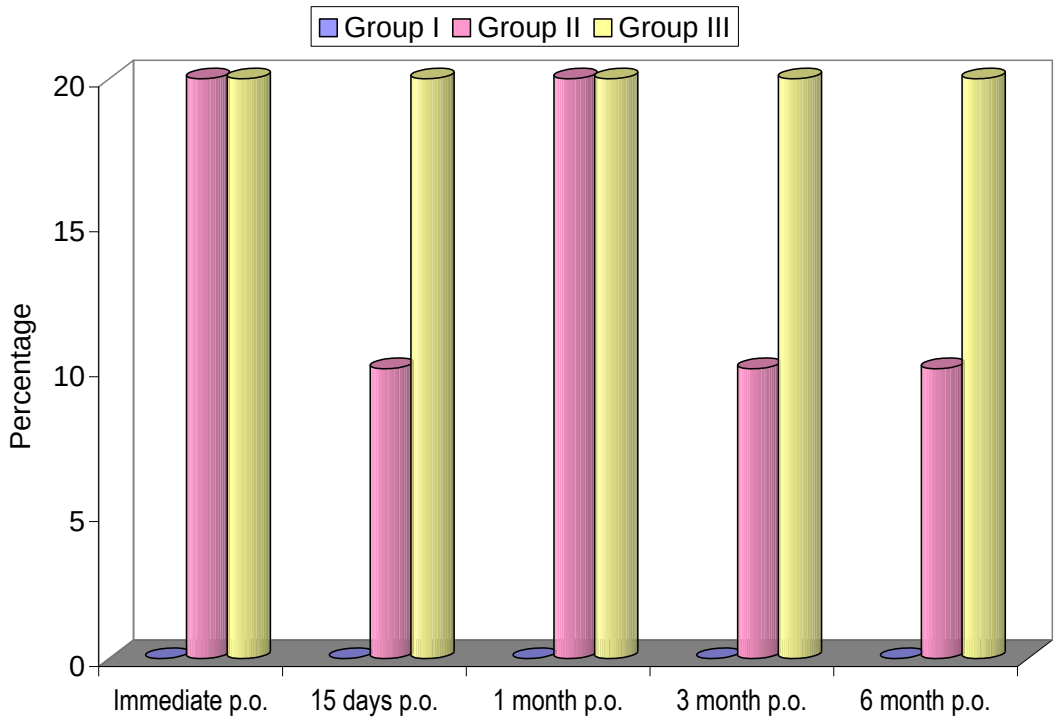
Similar results were found at follow up at 15th day, 1st month and 3rd months.

At 6th month inferior border malalignment was found in 1 (10.0%) patient of Group II, 2 (20.0%) patient of Group III and none (0.0%) patient of Group I. Difference in incidence of inferior border malalignment among the

groups was not found to be statistically significant (p=0.329) (**Table 4, Graph 5**).

Table 5: Intergroup Comparison of incidence of Improper Reduction of Fractured Segments in Study Population at different time intervals

Time Interval	Group I (n=10)		Group II (n=10)		Group III (n=10)		Statistical significance	
	No.	%	No.	%	No.	%	χ^2	P
Immediate p.o.	0	0.00	2	20.00	2	20.00	2.308	0.315
15 days p.o.	0	0.00	1	10.00	2	20.00	2.222	0.329
1 month p.o.	0	0.00	2	20.00	2	20.00	2.308	0.315
3 month p.o.	0	0.00	1	10.00	2	20.00	2.222	0.329
6 month p.o.	0	0.00	1	10.00	2	20.00	2.222	0.329



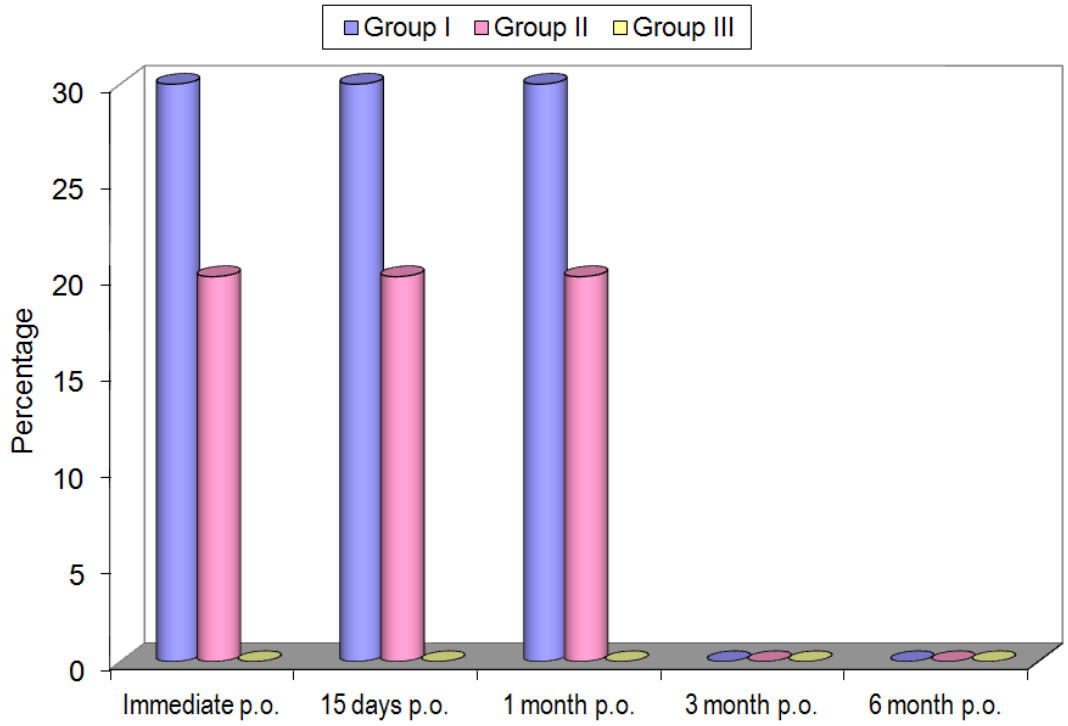
Graph 6: Intergroup Comparison of incidence of Improper Reduction of Fractured Segments in Study Population at different time intervals

Immediately after surgery, improper reduction of fractured segments was observed in none (0.0%) patients of Group I, 2 (20.0%) patients of Group II and 2 (20.0%) patients of Group III. Difference in incidence of improper reduction of fractured segments among the groups was not found to be statistically significant (p=0.315). Similar findings were observed at follow up at 1st month.

At follow up at 15th day post-operatively, 3rd month post-operatively and at 6th month post-operatively, improper reduction of fractured segments was observed in none (0.0%) patients of Group I, 1 (10.0%) patients of Group II and 2 (20.0%) patients of Group III. Difference in incidence of improper reduction of fractured segments among the groups at these follow up was not found to be statistically significant (p=0.329) (**Table 5, Graph 6**).

Table 6: Intergroup Comparison of incidence of Signs and Symptoms of Paraesthesia in Study Population at different time intervals

Time Interval	Group I (n=10)		Group II (n=10)		Group III (n=10)		Statistical significance	
	No.	%	No.	%	No.	%	χ^2	p
Immediate p.o.	3	30.00	2	20.00	0	0.00	3.360	0.186
15 days p.o.	3	30.00	2	20.00	0	0.00	3.360	0.186
1 month p.o.	3	30.00	2	20.00	0	0.00	3.360	0.186
3 month p.o.	0	0.00	0	0.00	0	0.00	-	-
6 month p.o.	0	0.00	0	0.00	0	0.00	-	-



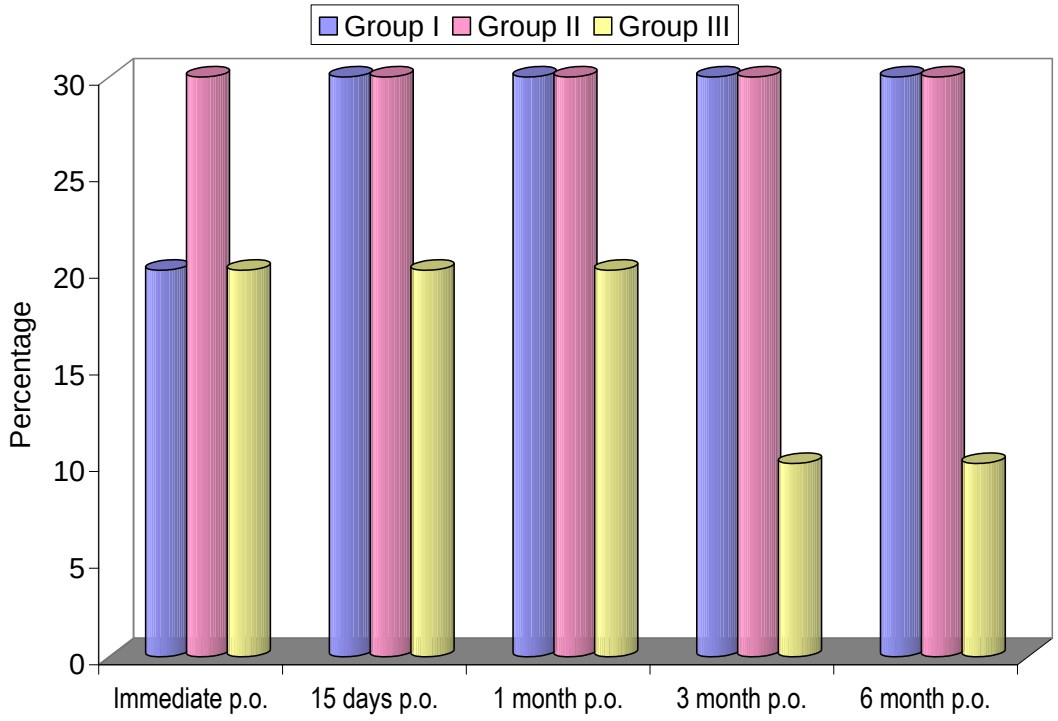
Graph 7: Intergroup Comparison of incidence of Signs and Symptoms of Paraesthesia in Study Population at different time intervals

Incidence of signs of paraesthesia, at immediate post-operatively were found in 3 (30.0%) of Group I, 2 (20.0%) of Group II and none (0.0%) of Group III patients. Similar observations were found at 15th day post-operatively and at 1st month post-operatively. Difference in incidence of signs of paraesthesia among the groups at immediate post-operatively, 15th day post-operatively and at 1st month post-operatively was not found to be statistically significant (p=0.186).

At 3rd month and 6th month intervals, none of the patients in any of the three groups had paraesthesia (**Table 6, Graph 7**).

Table 7: Intergroup Comparison of incidence of Occlusal Discrepancy in Study Population at different time intervals

Time Interval	Group I (n=10)		Group II (n=10)		Group III (n=10)		Statistical significance	
	No.	%	No.	%	No.	%	χ^2	p
Immediate p.o.	2	20.00	3	30.00	2	20.00	0.373	0.830
15 days p.o.	3	30.00	3	30.00	2	20.00	0.341	0.843
1 month p.o.	3	30.00	3	30.00	2	20.00	0.341	0.843
3 month p.o.	3	30.00	3	30.00	1	10.00	1.491	0.475
6 month p.o.	3	30.00	3	30.00	1	10.00	1.491	0.475



Graph 8: Intergroup Comparison of incidence of Occlusal Discrepancy in Study Population at different time intervals

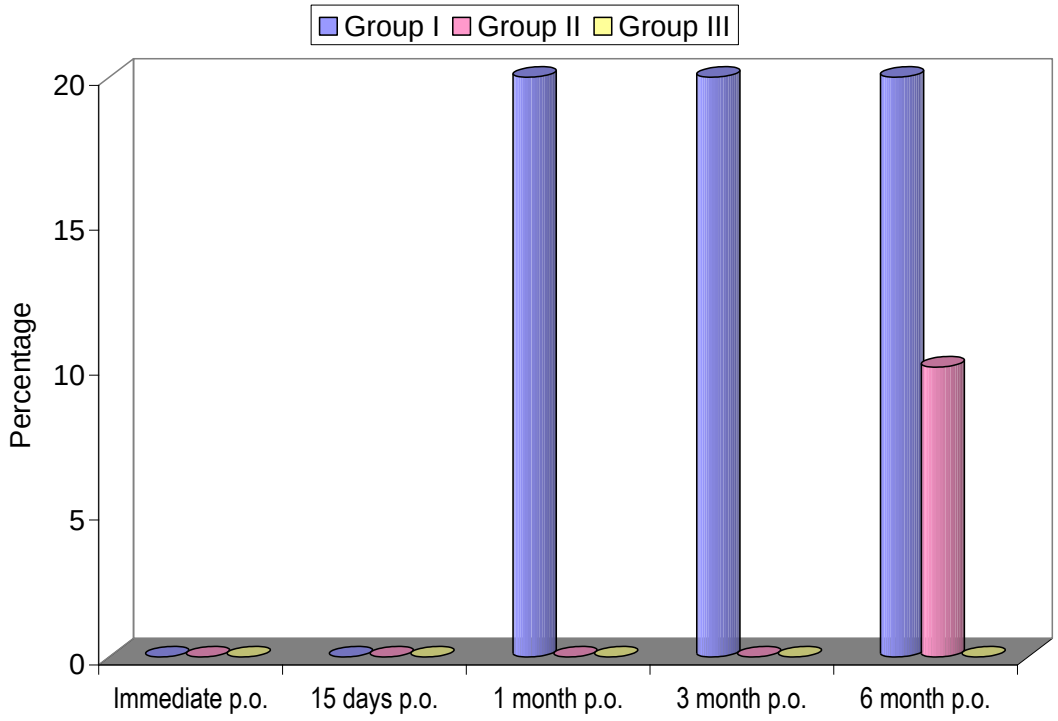
At immediate post-operatively incidence of occlusal discrepancy in Group II (30.0%) higher as compared to Group I (20.0%) and Group III (20.0%), difference in incidence of occlusal discrepancy was not found to be statistically significant (p=0.830).

At 15th day post-operatively and 1st month post-operatively occlusal discrepancy in Group I and Group II (30.0% each) was higher than that in Group III (20.0%) but this difference too was not found to be statistically significant (p=0.843).

At 3rd month post-operatively and 6th month post-operatively occlusal discrepancy in Group I and Group II (30.0% each) was higher than that in Group III (10.0%) but this difference too was not found to be statistically significant (p=0.475) (**Table 7, Graph 8**).

Table 8: Intergroup Comparison of incidence of Exposure of Implant in Study Population at different time intervals

Time Interval	Group I (n=10)		Group II (n=10)		Group III (n=10)		Statistical significance	
	No.	%	No.	%	No.	%	χ^2	p
Immediate p.o.	0	0.00	0	0.00	0	0.00	–	–
15 days p.o.	0	0.00	0	0.00	0	0.00	–	–
1 month p.o.	2	20.00	0	0.00	0	0.00	4.286	0.117
3 month p.o.	2	20.00	0	0.00	0	0.00	4.286	0.117
6 month p.o.	2	20.00	1	10.00	0	0.00	2.222	0.329



Graph 9: Intergroup Comparison of incidence of Exposure of Implant in Study Population at different time intervals

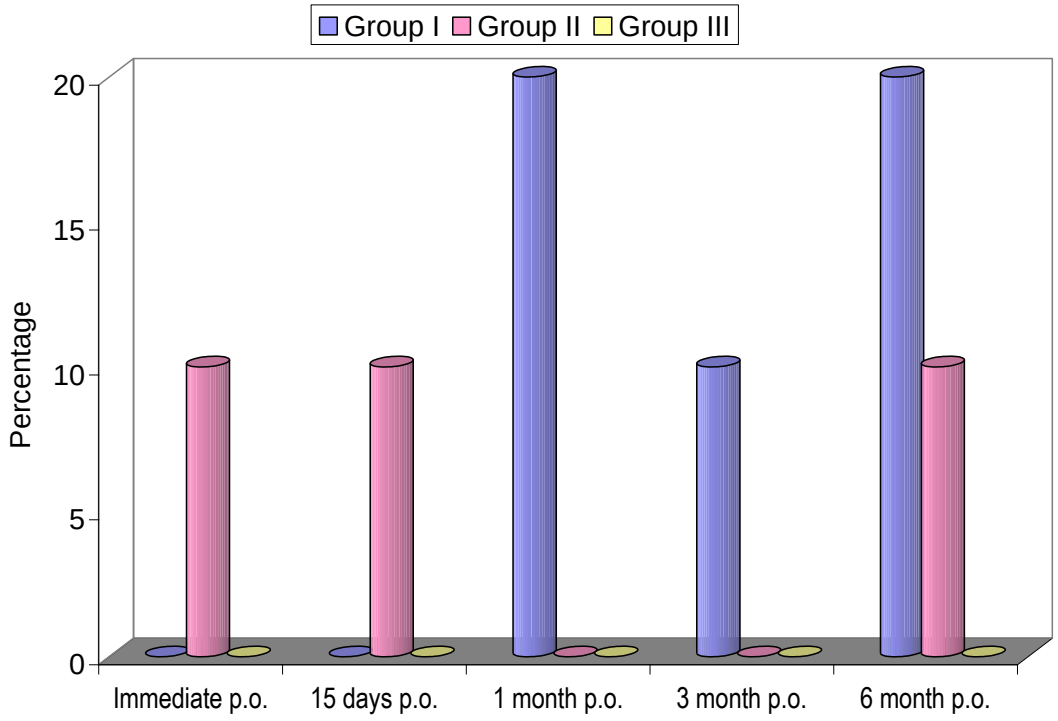
At Immediate post-operatively and at 15th day post-operatively in none of the patient from either group exposure of implant was observed.

At 1st month post-operatively and at 3rd month post-operatively exposure of implants were found in 2 patients of Group I (20.0%) and in none of the patients of Group II (0.0%) and Group III (0.0%). Difference in incidence of exposure of implants among the groups was not found to be statistically significant (p=0.117).

At 6th month post-operatively exposure of implants were found in 2 patients of Group I (20.0%), in 1 of Group II (10.0%) and none of Group III (0.0%). Difference in incidence of exposure of implants among the groups were not found to be statistically significant (p=0.329) (**Table 8, Graph 9**).

Table 9: Intergroup Comparison of incidence of Wound Dehiscence in Study Population at different time intervals

Time Interval	Group I (n=10)		Group II (n=10)		Group III (n=10)		Statistical significance	
	No.	%	No.	%	No.	%	χ^2	p
Immediate p.o.	0	0.00	1	10.00	0	0.00	2.069	0.355
15 days p.o.	0	0.00	1	10.00	0	0.00	2.069	0.355
1 month p.o.	2	20.00	0	0.00	0	0.00	4.286	0.117
3 month p.o.	1	10.00	0	0.00	0	0.00	2.069	0.355
6 month p.o.	2	20.00	1	10.00	0	0.00	2.222	0.329



Graph 10: Intergroup Comparison of incidence of Wound Dehiscence in Study Population at different time intervals

At immediate post-operatively and 15th day post-operatively, wound dehiscence was observed in only 1 (10.0%) patient of Group II and none in patients of Group I and Group III. Difference in incidence of wound dehiscence among the groups were not found to be statistically significant (p=0.355).

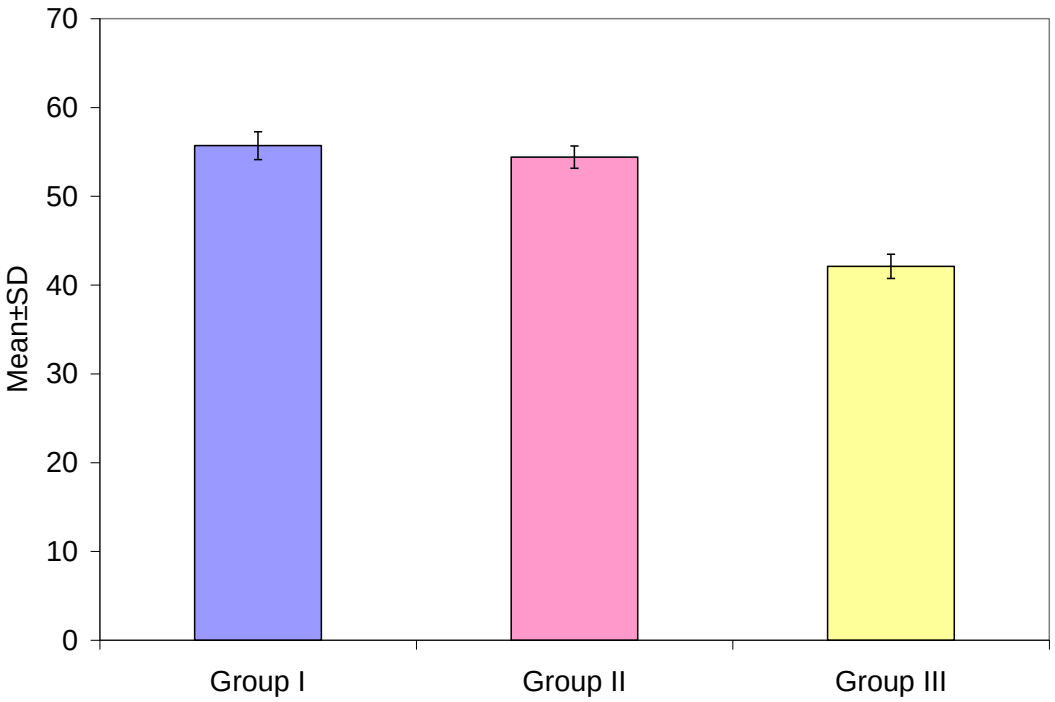
At 1st month post-operatively wound dehiscence was observed in 2 (20.0%) patients of Group I and none of the patients of Group II and Group III. Difference in incidence of wound dehiscence among the groups was not found to be statistically significant (p=0.117).

At 3rd month post-operatively wound dehiscence was observed in only 1 (10.0%) patients of Group I and none of the patients of Group II and Group III. Difference in incidence of wound dehiscence among the groups was not found to be statistically significant (p=0.355).

At 6th month post-operatively wound dehiscence was observed in 2 (20.0%) patients of Group II and 1 (10.0%) patient of Group I, while it was not observed in any patient of Group III. Difference in incidence of wound dehiscence among the three groups were not found to be statistically significant (p=0.329) (**Table 9, Graph 10**).

Table 10(a): Intergroup Comparison of Duration of Surgery in Study Population

Group	N	Minimum	Maximum	Median	Mean	S.D.
Group I	10	54	58	55.50	55.70	1.57
Group II	10	52	56	54.50	54.40	1.26
Group III	10	40	44	42.50	42.10	1.37
Total	30	40	58	54.00	50.73	6.38



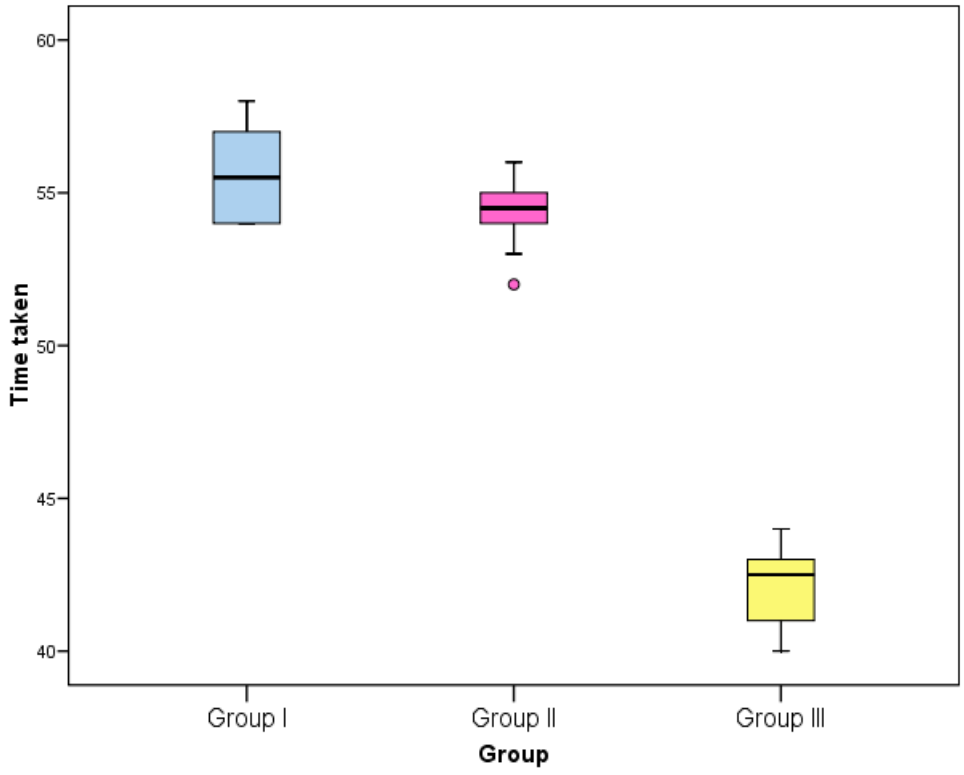
Graph 11: Intergroup Comparison of Duration of Surgery in Study Population

Time of Surgery in Group I ranged from 54-58 minutes while that in Group II was 52-56 minutes and in Group III was 40-44 min. Mean time for Surgery in Group I (55.70+1.57 min) was found to be highest followed by that

in Group II (54.40+1.26 min) and minimum in Group III (42.10+1.37 min) (**Table 10-a, Graph 11**).

Table 10(b): Analysis of Variance (Duration of Surgery)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1126.47	2	563.23	284.781	<0.001
Within Groups	53.40	27	1.98		
Total	1179.87	29			



Graph 12: Analysis of Variance (Duration of Surgery)

Above Table 10(b) and above box plot shows that difference in time of surgery among the above three groups was found to be statistically significant.

An overlap in interquartile values of duration of surgery of Group I and Group II was found. Order of duration of surgery of Group I and Group II was found to be higher as compared to that of Group III. A few extreme values in Group II were found (**Table 10-b, Graph 12**).

Table 10(c): Between Group difference in Duration of Surgery (Tukey HSD)

	Mean	**S.E.**	**'p'**
Group I & Group II	1.30	0.63	0.116
Group I & Group III	13.60	0.63	<0.001
Group II & Group III	12.30	0.63	<0.001

Difference in duration of Surgery between Group I & Group II (1.30+0.63) was not found to be statistically significant while difference between Group I & Group III (13.60+0.63) and between Group II & Group III (12.30+0.63) was found to be statistically significant(**Table 10-c**). Order of duration of surgery was-

Group III < Group II ≈ Group I

DISCUSSION

The present study was carried out in the Department of Oral & Maxillofacial Surgery, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow, to compare the stability and efficacy of different treatment modalities for management of parasymphysis fracture. A total number of 30 patients of parasymphysis fracture without pre-existing infection were selected. Patients were randomly divided into 3 equal groups of 10 patients each. Group I (mean age : 35.50 years) patients underwent two mini plates placed across the fracture site along with Erich's arch bar for six weeks. In Group II (mean age: 30.90) patients underwent two mini plates placed across the fracture site without Erich's arch bar. In Group III (mean age: 35.80) patients underwent single mini plate placed across the fracture site along with Erich's arch bar for six weeks.

This finding is consistent with the findings of Fridrich et al[16] (1992) reported that mandibular fracture occurs more in young adult males and females due to there greater involvement in the outdoor activities.

In the present study it was found that there was a marked preponderance of males-in Group I (8), in Group II (9), in Group III (8) and female-in Group I (2), in Group II (1), in Group III (2). Possibly males are subjected to more violence and outdoor activities in our society. This male dominance was also reported by Haug et al[59] (1990) who did a 5 year retrospective review of facial

fractures. This result is in accordance with study conducted by Hagan EH et al[60] (1961), Ellis et al[61] (1985) and Qudah MA[62] (2005). This may be justified by the fact that the males are generally more prone to situations in which there is higher risk of trauma.

The three groups were compared for eight parameters. The patients were evaluated on the immediate post operative, 15th day, 1stmonth, 3rd month and 6th month postoperatively.

Loosening of screws/plates was not observed in any patient of Group I and Group II at any time period of follow up while loosening was observed in Group III at follow up on 3rd month and 6th month post-operatively. No difference in incidence of loosening of screws among the groups was observed at immediate post-operative, 15th day and1st month post-operatively. Though at 3rdmonth post-operatively and 6thmonth post-operatively loosening of screws/plate was found in 1 (10.0%) patients of Group III whereas none was found in Group I and Group II. The data was statistically insignificant in the all three groups.

Immediately after the surgery inferior border malalignment was found in 2 (20.0%) patients of Group II, and 2 (20.0%) patients of Group III and no malalignment was found in patients of Group I. Difference in incidence of inferior border malalignment among all the three groups were not found to be statistically significant (p=0.315).Similar results were found at follow up of 15th day, Ist month and at 3rd month post-operatively. At 6th month post-

operatively inferior border malalignment was found in 1 (10.0%) patient of Group II, 2 (20.0%) patients of Group III and no malalignment was found in patients of Group I. Difference in incidence of inferior border malalignment among the groups was not found to be statistically significant.

Miniplates placed according to Champy's ideal lines of osteosynthesis. Champy advised the use of two miniplates in the anterior region, one at the inferior border and the second 5 mm above the lower plate. In the anterior part of the mandible, in front of the pre-molar, torsional movements are greater and higher when they are near the mandibular symphysis. Therefore, anterior to the mental foramina additional torsional forces are opposed by putting another plate 5 mm above the lower plate. These two plates counteracted the torsional as well the compressive force. This result is in accordance with study conducted by Champy et al[10] (1978), Gyorgy et al[63] (1984), Rix et al[15] (1991) and Tams et al[8] (1997).

Immediately after surgery, improper reduction of fractured segments was not observed in any patients of Group I, 2 (20.0%) patients of Group II and 2 (20.0%) patients of Group III. Difference in incidence of improper reduction of fractured segments among the groups was not found to be statistically significant (p=0.315). Similar findings were observed at follow up of 1stmonth.At follow up of 15th day, 3rd month and 6th month post-operatively. Improper reduction of fractured segments were not found in any patients of Group I, 1 (10.0%) patient of Group II and 2 (20.0%) patients of Group III.

Difference in incidence of improper reduction of fractured segments among the three group at these follow up periods was not found to be statistically significant. A minimum of 2 screws, on each side of fracture were used to prevent rotational movements of fractured segments which was in correlation with study of Schroll[64] (1927), Perren[65] (1969), Spiessel[13] (1976), Champy[10] (1978).

Incidence of signs of paraesthesia, at immediate post-operative period was found in 3 patients (30.0%) of Group I, 2 patients (20.0%) of Group II and none patients (0.0%) of Group III post-operatively. Similar observations were found at 15th day and 1st month post-operatively. Difference in incidence of signs of paraesthesia among the three groups at immediate post-operative, 15th day and 1st month post-operatively was not found to be statistically significant ($p=0.186$). At 3rd month and 6th month post- operatively, no paraesthesia was present in any patients of the all three groups. Difference in incidence of signs of paraesthesia among the groups were not found to be statistically significant. Disturbance of sensation classically occurs after mandibular fractures. The nerve may not only be injured or severed when fracture takes place but may be further damaged during manipulation of fractured fragments while reduction of fracture. The damage is usually minor if fragments are slightly displaced or not displaced, but is more if greater displacement of fragments is present Tuiovinen et al.[17](1994).

The patients with sensory disturbances regained their normal sensations after 6 weeks. This injury to mental nerve may have resulted from oedema or stretching of soft tissue during retraction [Cawood[14] 1985; Hayter et al.[66] 1993; Nakamura et al[18] 1994].

Rix et al[15] (1991) followed Champy's principle, but used a modification for parasymphysis fractures in close proximity to the mental foramen to avoid trauma to the nerve. Instead of the customary two plates, only one plate was placed above the foramen and supplemented with loop wiring which included two or more teeth on either side of the fracture line; their results were significant even with the use of this modification. In the present study, single miniplates with arch bar instead of loop wiring were used and the results were satisfactory.

At immediate post-operative period incidence of occlusal discrepancy in Group II (30.0%) was higher as compared to Group I (20.0%) and Group III (20.0%), difference in incidence of occlusal discrepancy was not found to be statistically significant (p=0.830). At 15th and 1stmonth post-operative period occlusal discrepancy in Group I and Group II (30.0% each) was higher than that in Group III (20.0%) but this difference was not found to be statistically significant (p=0.843). At 3rdmonth and 6th month post-operatively occlusal discrepancy in Group I and Group II (30.0% each) were higher than that in Group III (10.0%) but this difference was not found to be statistically significant. This findings is in correlation with the finding of Cawood et al[14]

(1985) who reported 8% incidence of malocclusion and Nakamura et al[18] (1994), Tuiovinen et al[17] (1994), Renton and Wisenfield[9] (1996).

Al-Belasy[11] (2005) studied whether a short period of maxillo-mandibular fixation followed by an arch bar splinted to the lower jaw is a suitable alternative to conventional maxillo-mandibular fixation for treatment of fractures of the mandibular tooth bearing area. Conventional 6 week maxillo-mandibular fixation was compared with another group who had maxillo-mandibular fixation for 2 weeks followed by an arch bar wired to the lower jaw. Al-Belasy found this method effective and in the present study, group III included patients with a lower arch bar along with a single miniplate, which gave satisfactory results.

There was no exposure of implant observed in either of the three groups at immediate and 15th day post-operatively. At 1st month and 3rd month post-operatively exposure of implants were found in 2 patients of Group I (20.0%) and in none of the patients of Group II (0.0%) and Group III (0.0%). Difference in incidence of exposure of implants among the groups were not found to be statistically significant (p=0.117).At 6thmonth post-operatively exposure of implants were found in 2 patients of Group I (20.0%), in 1 patient of Group II (10.0%) and none patient of Group III (0.0%). Difference in incidence of exposure of implants among the groups were not found to be statistically significant. This findings is in correlation with the finding of Chritah[30] (2005)-0%. However, it was 13.2% in the study of Nakamura et al [18] (1994).

At immediate and 15th day post-operatively wound dehiscence was observed in only 1 (10.0%) patient of Group II and none in patients of Group I and Group III. Difference in incidence of wound dehiscence among the groups were not found to be statistically significant (p=0.355). At 1st month post-operatively wound dehiscence was observed in 2 (20.0%) patients of Group I and none of the patients of Group II and Group III. Difference in incidence of wound dehiscence among the three groups were not found to be statistically significant (p=0.117). At 3rd month post-operatively wound dehiscence was observed in only 1 (10.0%) patient of Group I and none in patients of Group II and Group III. Difference in incidence of wound dehiscence among the three groups were not found to be statistically significant (p=0.355). At 6thmonth post-operatively wound dehiscence was observed in 2 (20.0%) patients of Group II and 1 (10.0%) patient of Group I while it was not observed in any patient of Group III. Difference in incidence of wound dehiscence among the three groups were not found to be statistically significant, however the infection was reported to be higher in group I. Infection rate seen in our study (10%) is in correlation with infection rate reported in the studies of Champy[10] (1978) -3.8%, Cawood[14] (1985)- 6%, Ellis et al[26] (2002) – 10%, Chritah[30] (2005)- 0% and Tuovinen et al [17] (1994)- 3.6%. As it has been claimed that mobility of fractured segments is a causative factor in post- operative infections. Wound dehiscence seen in our study was 10% which is similar in

studies of Champy[10] (1978) -3.9%, Cawood[30] (1985)- 12%, Tuovinen et al [17] (1994)- 2.2% and Chritah[30] (2005)- 15%.

Time of surgery in Group I ranged from 54-58 minutes while that in Group II was 52-56 minutes and in Group III was 40-44 min. Mean time for surgery in Group I (55.70±1.57 min) was found to be highest followed by that in Group II (54.40±1.26 min) and minimum in Group III (42.10±1.37 min).

Difference in duration of surgery between Group I & Group II (1.30±0.63) was not found to be statistically significant while difference between Group I & Group III (13.60±0.63) and between Group II & Group III (12.30±0.63) was found to be statistically significant. Order of duration of surgery was- Group III < Group II ≈ Group I (**ANOVA test**).

CONCLUSION

The outcome of the present study suggested that isolated parasymphysis fractures can be managed by using a single miniplate along with an Erich arch bar for 6 weeks, which will act as a tension band. This reduces the intra-operative time. It is economical for the patient as one miniplate is used instead of two. The use of single miniplate causes minimum injury to the mental nerve in the case of a fracture line running close to the mental foramen. It can be concluded that though miniplates are best placed following Champy's principle, isolated parasymphysis fractures can be managed by putting a single miniplate at the inferior border and utilizing the arch bar as a tension band for 6 weeks.

However, a long term study with large sample size is warranted to arrive at a definite conclusion.

BIBLIOGRAPHY

1. Saluja H, Kini Y, Mahindra U, Kharkar V, Rudagi BM, Dehane V. A comparative evaluation of different treatment modalities for parasymphysis fractures: A pilot study. *Int J Oral Maxillofac Surg* 2012; 41: 906-11.

2. Feller KU, Rechter G, Schneider M, Eckelt U. Combination of micro plate and mini plate for osteosynthesis of mandibular fracture: An experimental study. *Int J Oral Maxillofac Surg* 2002;31:78-83.

3. Arbag H, Husnu H, Ozturk K, Uyar Y. Comparative evaluation of different miniplates for internal fixation of mandibular fractures using finite element analysis. *J Oral Maxillofac Surg* 2008;66:1225-32.

4. Madsen MJ, McDaniel CA, Haug RH. A biomechanical evaluation of plating techniques used for reconstructing mandibular symphysis/ parasymphysis fractures. *J Oral Maxillofac Surg* 2008;66:2012-9.

5. Dodson TB, Perrott DH, Kaban LB, Gordon NC. Fixation of mandibular fractures: A comparative analysis of rigid internal fixation and standard fixation techniques. *J Oral Maxillofac Surg* 1990; 48:362-6.

6. Bolurian R, Lazow S, Berger J. Transoral 2.0 mm miniplates fixation of mandibular fractures plus 2 weeks maxillo-mandibular fixation: A prospective study. *J Oral Maxillofac Surg* 2002; 60:167-70.

7. Tams J, Van Loon JP, Rozema FR, Otten E, Bos RRM. A three-dimensional study of loads across the fracture for different fracture for different fracture sites of the mandible. *Br J Oral Maxillofac Surg* 1996; 34:400-5.

8. Tams J, Van Loon JP, Rozema FR, Otten E, Bos RRM. A three-dimensional study of bending and torsion movements for different fracture sites in the mandible: An in vitro study. *Int J Oral Maxillofac Surg* 1997; 26:383-8.

9. Renton TF, Wiesenfeld D. Mandibular fracture osteosynthesis: A comparison of three techniques. *Br J Oral Maxillofac Surg* 1996;34:166-73.

10. Champy M, Lodde JP, Schmitt R, Jaeger JH, Muster D. Mandibular osteosynthesis by miniature screwed plates via a buccal approach. *J Maxillofac Surg* 1978; 6:14-21.

11. Al-belasy FA. A short period of maxillomandibular fixation for treatment of fractures of mandibular tooth-bearing area. *J Oral Maxillofac Surg* 2005; 63:953-56.

12. Fordyes AM, Lalani Z, Songra AK, Hildert AJ, Carton ATM, Hawkesford JE. Inter-maxillary fixation is not usually necessary to reduce mandibular fractures. *Br J Oral Maxillofac Surg* 1999;37:52-7.

13. Spiessl B. Informal fixation of the mandible. A manual of AO/ASIF principles. *Br J Oral Maxillofac Surg* 1976;29:73-6.

14. Cawood JI. Small plate osteosynthesis of mandibular fractures. *Br J Oral Maxillofac Surg* 1985; 23:77-91.

15. Rix L, Stevenson ARL, Punnia- Moorthy A. An analysis of 80 cases of mandibular fractures treated with miniplate osteosynthesis. *Int J Oral Maxillofac Surg* 1991;20:337-41.

16. Fridrich KL et al. Changing tends with mandibular fracture: A review of 1067 cases. *J Oral Maxillofac Surg* 1992;50:586-9.

17. Tuovinen V, Norholt SE, Sindet-pedersen S. A retrospective analysis of 279 patients with isolated mandibular fractures treated with titanium miniplates. *J Oral Maxillofac Surg* 1994;52:931-5.

18. Nakamura S, Takenoshita Y, Oka. Complications of miniplate osteosynthesis for mandibular fractures. *J Oral Maxillofac Surg* 1994;52:233-8.

19. Valentino J, Marentte LJ. Supplemental maxillomandibular miniplate osteosynthesis fixation with miniplate osteosynthesis. *Otolaryngol head neck Surg* 1995;112:215-20.

20. Kuriakose MA, Fardy M, Sirikumara M, Patton DW, Sugar AW. A comparative review of 266 mandibular fractures with internal fixation

using rigid (AO/ASIF) plates or mini-plates. *Br J Oral Maxillofac Surg* 1996;34: 315-21.

21. Malata CM, McLean NR, Alvi R, McKiernan MV, Milner RH, Piggot TA. An evaluation of the Wiirzburg titanium miniplate osteosynthesis system for mandibular fixation. *Br J of Plastic Surg* 1997; 50: 26-32.

22. Kawai T, Murakami S, Hiranuma H, Sakuda M. Radiographic changes during bone healing after mandibular fractures. *Br J Oral Maxillofac Surg* 1997;35:312-8.

23. Maloney PL, Lincoln RE, Coyne CP. A protocol for the management of compound mandibular fractures based on the time from injury to treatment. *J Oral Maxillofac Surg 2001*;59:879-84.

24. Bolourian R, Stewart Lazow S, Berger J. Transoral 2.0-mm miniplate fixation of mandibular fractures plus 2 weeks' maxillomandibular fixation: a prospective study. *J Oral Maxillofac Surg* 2002; 60:167-70.

25. Haug RH, Street CC, Goltz M. Does plate adaptation affect stability? A biomechanical comparison of locking and non-locking plates. *J Oral Maxillofac Surg* 2002; 60:1319-26.

26. Ellis E, Graham J. Use of a 2.0-mm locking plate/screw system for mandibular fracture surgery. *J Oral Maxillofac Surg* 2002; 60:642-5.

27. Gabrielli MAC, Gabrielli MFR, Marcantonio E, Vieira EH. Fixation of mandibular fractures with 2.0-mm miniplates : Review of 191 cases. *J Oral Maxillofac Surg* 2003; 61:430-6.

28. Collins CP, Leonard GP, Tolas A, Alcalde R. A prospective randomized clinical trial comparing 2.0-mm locking plates to 2.0-mm standard plates in treatment of mandible fractures. *J Oral Maxillofac Surg 2004*; 62:1392-5.

29. King RE, Scianna JM, Petruzzelli GJ. Mandible fracture patterns: A suburban trauma center experience. *Am J Otolaryngol* 2004; 25:301-7.

30. Chritah A. Transoral 2.0-mm locking miniplate fixation of mandibular fractures plus 1 week of maxillomandibular fixation: A prospective study. *J Oral Maxillofac Surg* 2005;63:1737-41.

31. Madsen MJ ,Haug RH .A biomechanical comparison of 2 techniques for reconstructing atrophic edentulous mandible fractures. *J Oral Maxillofac Surg* 2006;64:457-65.

32. Mukerji R, Mukerji G, McGurkM. Mandibular fractures: Historical perspective. *Br J Oral and Maxillofac Surg* 2006;44:222–8.

33. Hermund NU, Hillerup S, Kofod T, Schwartz O, Andreasen JO. Effect of early or delayed treatment upon healing of mandibular fractures: a systematic literature review. *Dental Traumatology* 2008;24:22–6.

34. Korkmaz HH. Evaluation of different miniplates in fixation of fractured human mandible with the finite element method. *Oral Surg Oral Med Oral Pathol Oral Radio Endod* 2007;103:e1-e13.

35. Sauerbier S, Scho¨ N R, Otten Je, Schmelzeisen R, Gutwald R. The development of plate osteosynthesis for the treatment of fractures of the mandibular body: A literature review. *J Cr Maxillofac Surg* 2008; 36: 251-9.

36. Ellis E, Price C. Treatment protocol for fractures of the atrophic mandible. *J Oral Maxillofac Surg* 2008; 66:421-35.

37. Saikrishna D, Shetty SK, Marimallappa TR. A comparison between 2.0-mm standard and 2.0-mm locking miniplates in the management of mandibular fractures. *J Maxillofac Oral Surg* 2009; 8(2):145–9.

38. Lovato C, Wagner JD. Infection rates following perioperative prophylactic antibiotics versus postoperative extended regimen prophylactic antibiotics in surgical management of mandibular fractures. *J Oral Maxillofac Surg* 2009; 67:827-32.

39. Matos FP, Arnez MFM, Sverzut CE, Trivellato AE. A retrospective study of mandibular fracture in a 40-month period. *Int J Oral Maxillofac Surg* 2010; 39:10–5.

40. Ji B, Wang C, Liu L , Long J, Tian W, Wang W. A biomechanical analysis of titanium miniplates used for treatment of mandibular

symphyseal fractures with the finite element method. *Oral Surg Oral Med Oral Pathol Oral Radio Endod* 2010; 109:21-7.

41. Lovald S, Baack B, Gaball C, Olson G, Hoard A. Biomechanical optimization of bone plates used in rigid fixation of mandibular symphysis fractures. *J Oral Maxillofac Surg 2010*; 68:1833-41.

42. Sauerbier S, Kuenz J, Hauptmann S, Hoogendijk CF, Liebehenschel N, Scho N R, Schmelzeisen R. Clinical aspects of a 2.0-mm locking plate system for mandibular fracture surgery. *J Cr Maxillofac Surg* 2010; 38, 501-4.

43. Jain MK, Manjunath KS, Bhagwan BK, Shah DK. Comparison of 3-dimensional and standard miniplate fixation in the management of mandibular fractures. *J Oral Maxillofac Surg* 2010; 68:1568-72.

44. Lucca M, Shastri K, McKenzie W, James Kraus J, Finkelman M, Wein R. Comparison of treatment outcomes associated with early versus late treatment of mandible fractures: A retrospective chart review and analysis. *J Oral Maxillofac Surg 2010;* 68:2484-8.

45. Seemann R, Günter Lauer G, Poeschl PW, Schicho K, Pirklbaue M, Russmüller G, Krennmair G, Perisanidis C, Ewers R, Klug C. CROOMA, Complication rates of operatively treated mandibular fractures, paramedian and body. *Oral Surg Oral Med Oral Pathol Oral Radio Endod* 2011;111:449-54.

46. Engelstad ME, Kelly P. Embrasure wires for intraoperative maxillomandibular fixation are rapid and effective. *J Oral Maxillofac Surg* 2011; 69:120-4.

47. Ji B, Wang C, Song F, Chen M, Wang H. A new biomechanical model for evaluation of fixation systems of maxillofacial fractures. *J Cr Maxillofac Surg* 2012;40:405-8.

48. Hsu E, Crombie A, Marquart L, Batstone MD. Manual reduction of mandibular fractures before internal fixation leads to shorter operative duration and equivalent outcomes when compared with reduction with intermaxillary fixation. *J Oral Ac Surg* 2012; 70:1622-6.

49. Gokkulakrishnan S, Singh S, Sharma A, Shahi AK. An analysis of postoperative complications and efficacy of 3-D miniplates in fixation of mandibular fractures. *Dental Research Journal* 2012;9:2.

50. Ogura I, Kaneda T, Mori S, Sekiya K, Ogawa H, Tsukioka T. Characterization of mandibular fractures using 64-slice multidetector CT. *Dento maxillofac Radio* 2012; 41:392–5.

51. Yang R, Zhang C, Liu Y, Li Z. Why should we start from mandibular fractures in the treatment of panfacial fractures. *J Oral Maxillofac Surg* 2012; 70:1386- 92.

52. Ribeiro M, Lauria A, Sato FRL, Moreira RWF. Biomechanical analysis on different fixation techniques for treatment of mandibular body fractures. *Braz J Oral Sci* 2008;12(2):80-3.

53. Yamamoto MK, D'Avila RP, Luz JGC. Evaluation of surgical retreatment of mandibular fractures. *J Cr Maxillofac Surg* 2013; 41: 42-6.

54. Nayak SS, Pushpalatha C, Tammanavar PS, Naduwinmani SL, Mohan M. Efficacy of locking plates/screw system in mandibular fracture surgery. *J Contemp Dent Pract*. 2013; 14(2):222-6.

55. Vyas A, Mazumdar U, Khan F, Mehra M, Parihar L, Purohit C. A study of mandibular fractures over a 5-year period of time: A retrospective study.*Contemp Clini Dent* 2014; 5:4.

56. Noreen R, Khan M. Characteristics of symphysis and parasymphysis mandibular fractures. *Pakistan Oral & Dental Journal* 2014; 34:1.

57. Barde DH, Mudhol A, Ali FM, Madan RS, Kar S, Ustaad F. Efficacy of 3-D miniplates over champys miniplate in anterior mandibular fractures.*Br J Oral Maxillofac Surg* 2014;33:39-43.

58. Mohammad S, Pal US, Pradhan R, Singh N. Herbal remedies for mandibular fracture healing. *Nat J Maxillofac Surg* 2014; 36(5):1.

59. Haug RH, Prather J, Indrasano AT. An epidemiologic survey of facial fractures and concomitant injuries. *J Oral Maxillofac Surg* 1990;48:926.

60. Hagan EH, Huelke DR. An analysis of 319 case reports of mandibular fractures. *J Oral Maxillofac Surg* 1961;19:93-04.

61. Ellis E, Moos KF, El-Attar A. Ten years of mandibular fractures: An analysis of 2137 cases. *J Oral Maxillofac Surg* 1985;59:120-9.

62. Qudah MA, Al-Khateeb T. Mandibular fractures in Jordanians: A comparative study between young and adult patients. *J Craniomaxillofac Surg* 2005;33:103-6.

63. Gyorgy S. Champy plates in mandibular surgery. *Int J Oral Surg* 1984; 13:290-3.

64. Schroll et al. Rigid internal fixation of fractures of lower jaw. *Reconstr Surg Traumatol* 1927;13: 124-40.

65. Perren et al. The reaction of cortical bone to compression. *Acta Orthop Scand* 1969;138:175.

66. Hayter JP, Cawood JI. The functional case for miniplates in maxillofacial surgery *Int J Oral Maxillofac Surg*1993;22(2):91-6.

ANNEXURES

ANNEXURE-I

PATIENT INFORMATION SHEET

Study Title_____

Study Number_____

Subject's Full Name_____

Date of Birth/Age_____

Address_____

1. I confirm that I have read and understood the information sheet dated_____ for the above study and have had the opportunity to ask questions.

OR I have been explained the nature of the study by the investigator and had the opportunity to ask questions.

2. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason and without my medical care or legal right being affected.
3. I understand that the Ethical Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the study. However, I understand that my Identity will not be revealed in any information released to third parties or published.
4. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).
5. I agree not to claim for any kind of compensation under any circumstances.
6. I agree to take part in above study.

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative(guardian)____

Signatory' Name_____ Date_____

Signature of the Investigator_____ Date_____

Study Investigator's Name_____ Date_____

Signature of the Witness_____ Date_____

Name of the Witness_____

ANNEXURE-II

सरदार पटेल स्नाकोत्तर दंत विज्ञान एंव आयुर्विज्ञान संस्थान, लखनऊ

सूचित सहमति पत्र

अध्ययन शीर्षक .....

अध्ययन नम्बर .....

सहभागी का पूरा नाम .....

जन्म तिथि/उम्र .....

पता .....

1. मेरी पुष्टि है कि मैंने उपरोक्त परीक्षण हेतु जानकारी पत्र दिनांक ..... को पढ़ व समझ लिया है तथा मुझे प्रष्न पूछने के अवसर प्रदान किये गये।

अथवा

2. मुझे अध्ययन अन्वेषक ने विस्तार सें सब तथ्यों को समझा दिया है तथा मुझे प्रष्न पूछने का अवसर प्रदान किया।

3. मैंने समझ लिया है कि इस अध्ययन में मेरी प्रतिभागिता स्वैच्छिक है, तथा यह कि मैं बिना कोई कारण बतायें किसी भी समय अपनी चिकित्सीय देखभाल या कानूनी अधिकारों पर कुप्रभाव पड़े बिना हट जाने के लिए स्वतन्त्र हूँ।

4. मैंने समझ लिया है कि चिकित्सीय प्रायोजक की ओर से काम करने वाले अन्य, नैतिकता समित तथा विनियामक प्राधिकारों का चालू अध्ययन तथा इससे सम्बन्धित हो सकने वाले किसी अनुसंधान सम्बन्धित मेरे स्वास्थ्य अभिलेखों को देखने के लिए मेरी अनुमति की आवष्यकता नहीं होगी, भले ही मैं इस परीक्षण से हट ही क्यों न जाऊ। तथापि मैंने समझ लिया है कि तृतीय पक्ष को दी गई या प्रकाषित की गई किसी जानकारी में मेरी पहचान को उजागर नहीं किया जायेगा।

5. इस अध्ययन में प्राप्त किन्हीं आंकड़ों या परीक्षणों के प्रयोग पर पाबंदी न लगाने के लिये मैं सहमत हूँ बशर्त कि ऐसे प्रयोग मात्र वैज्ञानिक प्रयोजन/नों के लिये ही हों।

उपयुक्त अध्ययन में भाग लेने के लिए मैं सहमत हूँ।

सहभागी के हस्ताक्षर या अंगूठे का निषान/कानूनी रुप से स्वीकार्य प्रतिनिधि .....

हस्ताक्षर करने वाले का नाम ..... दिनांक .....

अध्ययन अन्वेषक के हस्ताक्षर ..... दिनांक .....

अध्ययन अन्वेषक का नाम ..... दिनांक .....

माता–पिता/अभिभावक के हस्ताक्षर ..... दिनांक .....

माता–पिता/अभिभावक का नाम .....

ANNEXURE-III

CASE SHEET

DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY

O.P.D No.

Date :

Name :

Age/Sex:

Residential address :

Contact no.:

Chief complaint of the patient:

Personal history:

History of present illness:

Family history:

History of past illness:

Vitals : B.P -

Pulse -

Respiration-

Extra oral examination:

Soft tissue: Hard tissue :

Intra oral examination:

Soft tissue: Hard tissue:

Provisional diagnosis:

Investigations :

Blood investigation:

Radiographs :

Any other :

Final diagnosis :

Treatment plan :

Work done: