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Evaluation of neurosensory changes of inferior alveolar nerve in mandibular angle and body fractures – A descriptive study

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Abstract

Background: Mandibular fractures accounts for approximately two-thirds of all the maxillofacial fractures. Fractures of mandible that lie between mental and mandibular foramina can result in damage to inferior alveolar nerve. This damage can be the direct result of damage to nerve during trauma or can result intra operatively during fixation of the fractured mandible. Current literatures lack definite information regarding the progression and regression of neurosensory deficit mainly due to inconsistent sensory testing, lack of censored data and follow up, variable duration and scoring and different treatment techniques. This study aims to rectify these deficits and to arrive at a definite conclusion.

Materials and Methods: This study is a descriptive study of 160 patients who presented with unilateral isolated angle and body fractures. Neurosensory testing was carried out immediately after trauma and after 1 week, 1 month and at 6 months. CBCT was used to measure the displacement between the fractured segments.

Results: The results of this study showed that males of the mean age group 52.5±9.287 years were more prone for angle and body fractures. About 62.5% were not associated with any paraesthesia. At the end of 6 months only 1.9% of patients had mild neurosensory changes and 0.6% had severe changes.

Conclusion: There is a statistically significant association between the displacement, pattern of fracture and the neurosensory change. Neurosensory changes were observed in only those fractures which were displaced >1 mm. In those fractures with displacement <4 mm the neurosensory changes recovered fully within 1 week. In those fractures with displacement >5 mm, it took about 1 month to recover and in those cases with deficit persisting even after 1 month it didn't recover after 6months.

Keyword: mandibular angle fracture, mandibular body fracture, neurosensory testing, mandibular nerve, nerve injury.

Introduction

Fridrich and associates[1] showed that most fractures occur in the body (29%), condyle (26%) and angle (25%) of the mandible. The symphysis account for 17%, ramus 4% and coronoid process 1%. Fridrich and associates[1] showed that most fractures occur in the body (29%), condyle (26%) and angle (25%) of the mandible. The symphysis account for 17%, ramus 4% and coronoid process 1%. The most common causes of mandibular angle and body fractures are motor vehicle accidents, interpersonal violence, falls and sports related injuries. In assault cases mandibular angle demonstrated the highest incidence of fractures.

Fractures of mandible that lie between mental and mandibular foramina can result in damage to inferior alveolar nerve. This damage can be the direct result of damage to nerve during trauma or can result intra operatively during fixation of the fractured mandible. The incidence of neural injury of the inferior alveolar nerve was found to be 42.3%. comminuted and displaced linear fractures of mandibular angle and body region were associated with higher incidence of inferior alveolar nerve injury and prolonged recovery time, and recovery of inferior alveolar nerve function occurred in 91%.

Current literature lacks definite information regarding the progression and regression of neurosensory deficit mainly due to inconsistent sensory testing, lack of censored data and follow up, variable duration and scoring and different treatment techniques. This study evaluates the neurosensory changes associated with mandibular angle and body fractures and its relation with displacement and pattern of fractures.

Material And Methods

The descriptive study was conducted in the Department of Oral and Maxillofacial Surgery, Government Dental College and Government Medical College, Kottayam. 160 patients with unilateral isolated angle and body fractures were randomly selected after obtaining written informed consent. The study was conducted over a period of 18 months (January 2018-june 2019). Neurosensory testing was carried out immediately, 1 week, 1 month and at 6 months. CBCT was used to measure the displacement between the fractured segments.

Study Design: Longitudinal descriptive study

Study Location: Department of Oral and Maxillofacial Surgery, Government Dental College and Government Medical College, Kottayam.

Study Duration: January 2018-june 2019

Sample size: 160 patients.

Subjects & selection method: If the patient had reported paresthesia at the time of evaluation neurosensory testing was done which was repeated after 1 week, 1 month and 6 months. Initially the Level A (sensory) was assessed by brush stroke direction and two-point discrimination which was compared with the normal side. If deficiency is noted the test is proceeded to Level B (proprioception). This was analysed by the pin prick test. Those patients who had neurosensory deficiency were analysed for Level C (temperature) using a test tube filled with hot or cold water. All these tests were performed on 5 areas- below the labiomental fold, above the labiomental fold, lower lip at commissure, lower lip from commissure to midline, and the tongue. The greatest level obtained among these five areas were considered for evaluation. Thus, the level of neurosensory change was assessed as mild, moderate and severe respectively. All these tests were repeated at regular intervals to assess the progress.

Inclusion Criteria

1. Age greater than 18 years
2. Unilateral angle and body fracture posterior to mental foramen
3. No other fractures of mandible
4. Patients consent to participate

Exclusion Criteria

1. Previous history of paraesthesia of lower jaw region.
2. Facial palsy patients
3. Patients who cannot respond properly (mentally retarded, comatose patients)
4. Patients with neuronal injuries

Procedure Methodology

The present clinical study was undertaken to evaluate whether the neurosensory changes of the inferior alveolar nerve is dependent on the amount of displacement and the pattern of fracture in mandibular angle and body fractures.

The parameters which were analysed in this study was:

- The relationship between the extent and duration of inferior alveolar neurosensory change and the displacement of fractured segments in the mandibular angle and body region.
- The relationship between the extent and duration of inferior alveolar neurosensory change and the pattern of fracture in the mandibular angle and body region.

Statistical Analysis

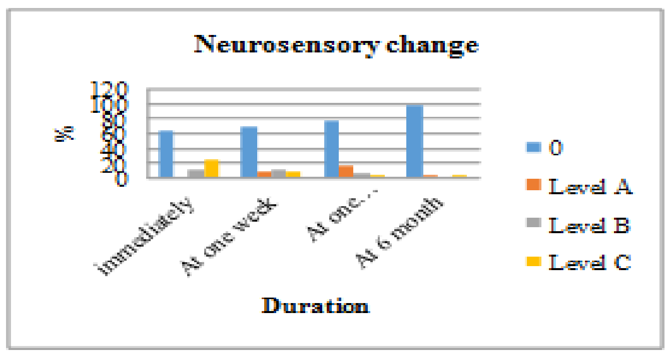
The results were analysed by Fischer's T test using the SPSS software. Level of significance was set at $p < 0.05$.

Result

Out of the 160 patients analyzed it was found that the younger age groups suffered more from mandibular angle and body fractures. Those patients in the age group 18- 30 were more frequently affected (70%) followed by those in the age groups of 31-50 years (20%).

The least commonly affected were the older people- 51-70 years (6.3%), and 71-90-year-old patients (3.8%). The mean age was 52.5 ±9.287.

Figure 1: comparison between neurosensory change and duration



Of the 160 patients about 62.5% were not having any neurosensory changes immediately. 12.5% of the patients had neurosensory changes in Level B tests (moderate neurosensory changes). 25% had neurosensory changes in Level C (severe). 1 week after the initial examination 70% of the patients were not having any neurosensory change. Mild neurosensory change (those responded to Level A) was observed in 8.1% and moderate neurosensory change were noted in 12.5% of patients. 9.4% had severe neurosensory changes.

At 1 month only 0.6% were found to have severe neurosensory changes. 6.3% had moderate and 15.6% had mild neurosensory deficits. Rest of the patients were free of any neurosensory deficits.

At 6 months no neurosensory deficits were found in 97.5% of the patients. Mild neurosensory deficits were found in 1.9% of the patients and severe in only 0.6% of the patients.

Displacement	NS0			Total	P value (Fisher exact test)
	Nil	Level B	Level C		
0-1	16	0	0	16	0.0001
2-3	72	0	0	72	
4-5	12	20	8	40	
>5	0	0	32	32	
Total	100	20	40	160	

Table 1: comparison of immediate neurosensory change and displacement.

By means of Fischer's exact test the association between the displacement and immediate neurosensory changes were analysed. It was noted that those who had greater than 5 mm of displacement between the fracture segments had sever neurosensory deficits and in those patients with less than 1 mm of displacement between the fracture segments neurosensory changes were not seen. The p value obtained is 0.0001. The relation is found to be statistically significant.

Displacement	Neurosensory change at 1 week			Total	P value (Fisher exact test)
	Nil	Level A	Level B		
0-1	16	0	0	16	.0001
2-3	72	0	0	72	
4-5	24	13	3	40	
>5	0	0	17	32	
Total	112	13	20	160	

Table 2: comparison of neurosensory change at 1 week and displacement.

At 1 week the neurosensory changes were found to be decreasing in those patients who had large displacements. Those who had fracture displacement less than 4 mm the neurosensory deficits were healed completely. The study was found to be statistically significant with a p value of 0.0001.

Displacement	Neurosensory change at 1 month			Total	P value (Fisher exact test)
	Nil	Level A	Level B		
0-1	16	0	0	16	0.0001
2-3	72	0	0	72	
4-5	35	4	1	40	
>5	1	21	9	32	
Total	124	25	10	160	

Table 3: comparison of neurosensory change after 1 month and displacement.

1 month after the incident it was found that only few of the patients who had fracture displacement less than 5 mm had mild neurosensory deficit. The relationship was found to be statistically significant with p value of 0.0001.

Displacement	Neurosensory change at 6 months			Total	P value (Fisher exact test)
	Nil	Level A	Level B		
0-1	16	0	0	16	0.012
2-3	72	0	0	72	
4-5	40	0	0	40	
>5	28	3	1	32	
Total	156	3	1	160	

Table 4: comparison of neurosensory change after 6 months and displacement.

After 6 months it was found that neurosensory deficits persisted only in few of the patients who had displacement between the fracture segments greater than 5 mm. this relationship was also found to be statistically significant with a p value of 0.012.

All the favourable undisplaced fractures were treated by closed reduction and the unfavourable displaced fractures were treated by open reduction and internal fixation.

Type of Treatment	Neurosensory change at 1 month				Total	P value (Fisher exact test)
	Nil	Level A	Level B	Level C		
Closed Favorable	16	0	0	0	16	0.034
Open unfavorable	108	25	10	1	144	
Total	124	25	10	1	160	

Table 5: comparison of type of treatment/ pattern of fracture and neurosensory change.

The relationship between the neurosensory change and the pattern of fractures were analysed and it was found that the favourable fractures were not associated with any neurosensory deficits. Unfavourable fractures had neurosensory deficit. theis analysis was found to be statistically significant with a p value of 0.034.

Discussion

Neurosensory changes can occur in mandibular angle and body fractures because of damage to the inferior alveolar nerve. The incidence of neurosensory deficit in the inferior alveolar nerve distribution after mandibular fractures is not well documented. Moreover, there is inadequate information regarding prognosis for recovery of inferior alveolar nerve neurosensory function. Previous retrospective reviews of mandibular fractures either lack post-trauma sensory information or include fractures that do not involve the mandibular canal. Other retrospective reviews of mandibular fractures do not address sensory changes.

Iizuka and Lindqvist[2] published the most relevant data available on the incidence of sensory deficit after mandibular fractures involving the mandibular canal. This was a study of sensory disturbances associated with rigid internal fixation of mandibular fractures.

In the present study, the mean age was 52.5 ±9.287. An immediate post traumatic sensory deficit was found in 35.5% of the patients.

Most authors have reported sensory disturbances as an incidental finding or only in patients who subjectively complained about this problem. Furthermore, many of these studies included fractures not involving the mandibular canal, and others did not address direct injury to the inferior alveolar nerve.

Iizuka and Lindqvist's[2] report of persistent paresthesia (mean follow up, 15.9 months) in 46.6% of patients with post-traumatic sensory deficit is the only relevant information available. However, 76% of these patients had displaced fractures, 30% had edentulous mandibles, and they were all treated with open reduction and rigid internal fixation.

The results of our study indicate that inferior alveolar nerve neurosensory scores were persistent after 6 months follow up in only 0.6% of the patients analyzed. According to Queral- Godoy et al[3], quicker healing of the inferior alveolar nerve and favorable long-term outcomes are often seen because the nerve is encased within a bony canal. The results suggest that fracture displacement and location are the key variables associated with worsening of the inferior alveolar nerve sensory score. When displacement of the fracture line was present, a greater incidence of neurosensory deficit and more prolonged recovery should be expected. The suspected reasons for this are trauma to the nerve by the displacement itself and additional trauma during surgical reduction and repair.

Patients with a fracture displaced more than 5 mm had increased risk of an adverse effect on the neurosensory score after treatment compared with fractures displaced 5mm or less. As all the patients were treated with open reduction and internal fixation, with mini-plates, mono-cortical screws, and anatomical placement, the risk of a worsening of the inferior alveolar neurosensory score after treatment was low. Stacey et al[4], reported that the use of non-compressive mini-plate fixation of mandibular fractures is effective due to its low morbidity and complications.

The strengths of this study are its prospective and descriptive design and consistency of collection of inferior alveolar nerve sensory data during the study. The method of neurosensory measurement used is well documented, suitable for peri-operative evaluations, and commonly used in follow up studies of mandibular fractures.

The results of the present study suggest that the inferior alveolar nerve neurosensory status is recovered after mandibular fracture treatment in almost all patients. Inferior alveolar nerve neurosensory status worsening was not observed after treatment. This result is consistent with the results of a study by Schultze-Mosagu et al.[5], in which there was no increase in neurosensory deficits after surgical treatment.

In the present study the risk factors affecting the neurosensory outcome were found to be fracture pattern and fracture displacement. Recovery of neurosensory change postoperatively was observed less often in cases with fracture displacement of more than 5 mm compared to cases with less than 5 mm fracture displacement.

Conclusion

Fractures of mandible that lie between mental and mandibular foramina can result in damage to inferior alveolar nerve. This damage can be the direct result of damage to nerve during trauma or can result intra operatively during fixation of the fractured mandible. The reason for improvement or no further deterioration of the condition is attributed to the fact that this nerve is encased within the canal.

The present study was conducted to evaluate the relationship between extent and duration of neurosensory changes of inferior alveolar nerve and amount of displacement of fractured segments and the relationship between extent and duration of neurosensory changes of inferior alveolar nerve and pattern of fractures (favourable or unfavourable).

To conclude, the neurosensory changes are dependent on the fracture displacement and fracture pattern.

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