

**CLINICAL STUDY****ROLE OF ORTHOPANTOMOGRAPHY  
IN DIAGNOSIS AND TREATMENT  
PLANNING OF FRACTURE MANDIBLE**PARAMJIT<sup>1</sup> AHLUWALIA T. P. S.<sup>2</sup><sup>1</sup>Sr. Lecturer, Department of  
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National Dental College & Hospital,  
Gulabgarh, Dera Bassi (Punjab)**ABSTRACT****Aims and objectives:** To evaluate the panoramic radiographs taken with single exposure for detection of mandible fractures as compared with conventional radiographs.

To evaluate the reliability of panoramic radiographs for the detection of fractures of the mandible.

**Material and methods:** Fifty patients with evidence of fractured mandible were included in the present study. The diagnostic accuracy of panoramic and conventional radiographs were compared for the fracture lines in terms of visibility i.e. "with full extent", "traceable" and "not visible". The degree of fractured segments in terms of "undisplaced", "minimally displaced" and "considerably displaced" was also noted.**Observations and results:** All fracture lines which were visible "with full extent" on panoramic radiograph gave 98.77% reliability as compared to conventional radiographs which showed 87.65% reliability. The amount of displacement in terms of separation or overriding of fragments was more clearly visible on panoramic radiographs as compared to conventional radiographs.**Conclusion:** Orthopantomography is superior to the conventional radiography in diagnosis and treatment planning of fractured mandible and should substitute the conventional extra-oral radiographs.**Key words:** OPG, fracture mandible, panoramic zonography, conventional x-ray.**Address for Correspondence:****PARAMJIT**Sr. Lecturer, Department of  
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e-mail: rajkajla2002@gmail.com**INTRODUCTION**

A fracture is a sudden violent solution of the continuity of bone which may be complete or incomplete in character. Fractures of the mandible make up approximately two thirds of all the facial fractures. It is the second most common facial bone and tenth in the whole body to get fractured. For provisional diagnosis, although history and clinical examination by a competent observer is usually sufficient but radiographic examination is very essential for accurate interpretation of the precise nature of the injury such as the exact relationship of teeth to a fracture line, to know accurately whether a fracture of condyle involves the joint space or to determine the presence or otherwise of comminution of the lower border of the

body of the mandible. The radiographs are considered as an indispensable adjunct in oral diagnosis and play a vital role in detecting, evaluating and even treatment planning of various lesions of the teeth and oral cavity including traumatic injuries.

The routine radiographic examination such as right and left Lateral Oblique in case of fractured mandible require several radiographic views, which necessitate more manipulation of the patient causing more discomfort and increased radiation exposure of the patient. It is also occasionally inadequate to reveal the fractures of mandible at various sites. Currently Panoramic radiography, a type of body sectional tomography, is becoming more popular amongst the oral surgeons to detect

fractures of the mandible as it provides broader coverage of image areas of facial bones including all the teeth of the both arches along with their supporting tissues and entire mandible from right to left including condyles on a single x-ray film. It causes minimal discomfort and reduced radiation exposure of the patient with an added advantage of being less time consuming and cost effective.

The present study was carried out in a series of fifty patients who reported at oral and maxillofacial surgery Department, Government Dental College and Hospital, Amritsar with clinical evidence of fractured mandible. An attempt was made to evaluate and compare the reliability of panoramic radiographic examination with conventional radiography and its value in assisting the oral surgeon in

diagnosis and treatment planning of fractured mandible.

### MATERIALS AND METHODS

Fifty patients with evidence of fractured mandible were selected at random irrespective of age, sex, caste, creed and social economic status who reported to the department of OMFS at Govt. Dental College and Hospital, Amritsar with clinical evidence of fractured mandible excluding dentoalveolar fracture to evaluate and compare the reliability of panoramic radiography, with that of conventional radiography in detection of fracture mandible.

Relevant history was taken, clinical examination done and provisional diagnosis made. The panoramic radiographs were taken on "PANEX" model 100 E.C., orthopantomograph unit, operating at an average of 90 kVp, 8 mA with 15 seconds exposure. Patients were submitted to single exposure to evaluate the diagnostic accuracy of pantomographic radiography.

Along with history and clinical examination, other necessary routine extraoral radiographs were taken, which included right or left lateral oblique and postero-anterior views of mandible.

All the radiographs were developed using standard technique and observation of the routine and panoramic radiographs for fracture lines in terms of visibility "with full extent", "traceable" and "not visible", was recorded.

Degree of displacement of fractured segments in terms of "undisplaced", "minimally displaced" and "considerably displaced" was noted. Information provided by panoramic radiographs like site of the fracture, tooth involved in the fracture line if present were also recorded. The diagnostic accuracy of panoramic and conventional radiographs was compared (Table V).

## OBSERVATIONS AND RESULTS

### Observations and results

Table I

Age group in years	No. of patients	Percentage
10-19	7	14.0
20-29	19	38.0
30-39	15	30.0
40-49	7	14.0
50-59	2	8.0
Total	50	100.00

Table – 1 shows the age range of the patients was 18-50 years averaging 34 years. The highest incidence of mandibular fractures was seen at the third decade of life followed by fourth decade.

Table – II  
Sex wise distribution of the patients

Sex	No. of patients	Percentage
Male	46	92.0
Female	4	8.0
Total	50	100.0

Table II shows sex wise distribution of the patients with mandibular fractures. Young males were most susceptible to trauma and fracture due to their dominant, outdoor activities. In the present study, only 4 (8%) patients were females and rest 46 (92%) were males giving a male to female ratio of 11.5:1.

Table III  
Etiology of the mandibular fracture

Age group in years	No. of patients	Percentage
10-19	7	14.0
20-29	19	38.0
30-39	15	30.0
40-49	7	14.0
50-59	2	8.0
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Table III  
Etiology of the mandibular fracture

Cause	No. of patients	Percentage
Road traffic accidents	36	72.0
Assaults	9	18.0
Falls	2	4.0
Sports related accidents	2	4.0
Others	1	2.0
Total	50	100.0

Table III shows the etiology of mandibular fractures. Road traffic accidents (72%) were the most frequent cause followed by assaults (18%), fall (4%), sports related accidents (4%) and other causes (2%).

Table IV  
Anatomical site wise distribution of the fractured mandible

Location	No. of fractures	Percentage
Symphysis-parasymphysis	10	19.38
Body	13	14.81
Angle	13	16.05
Ramus	1	1.24
Coronoid process	1	1.24
Condyle	14	17.28
Total	51	100.0

Table IV shows site wise distribution of the fracture of the mandible. The symphysis and parasymphysis region was the commonest site involved (49.38%) followed by condyle (17.28%), angle (16.05%), body (14.81%), ramus (1.24%) and the coronoid process (1.24%).

Table V  
Site wise distribution of the fractured mandible observed on OPG and conventional radiographs

Site of the fracture	No of fracture lines detected on OPG			Total no. of fractures	No. of fracture lines detected on conventional radiographs		
	With full extent	traceable	Not visible		With full extent	Traceable	Not visible
Symphysis and parasymphysis	39	00	01	40 (49.38%)	36	04	00
Angle of mandible	13	00	00	13 (16.04%)	11	02	000
Condylar process	14	00	00	14 (17.26%)	12	02	00
Body of mandible	12	00	00	12 (14.81%)	12	00	00
Ramus of mandible	01	00	00	01 (1.23%)	00	00	01
Coronoid process	01	00	00	01 (1.23%)	00	00	01
Total	80 (98.77%)	00	01	81 (100%)	71 (87.65%)	08 (9.87%)	02 (2.46%)

Table V shows the comparison of extent of visibility of fracture line on panoramic radiographs and conventional radiographs in terms of “with full extent”, “traceable” and “not visible”.

On panoramic view, all fracture lines were visible “with full extent”, except one fracture line in the symphysis region giving 98.77% reliability of this recent radiographic examination in detection of mandibular fractures.

On conventional view, 2 fracture lines out of 81 were “not visible”. Thus a total of 71 fracture lines were visible “with full extent” on conventional views giving (87.65%) reliability.

Table VI  
Incidence of involvement of tooth in fracture line

Tooth involved	No. of fractures	Percentage
Central incisor	11	18.03
Lateral incisor	05	8.19
Cuspid	14	22.95
First bicuspid	08	13.11
Second bicuspid	08	13.11
First molar	01	1.63
Second molar	02	3.27
Third molar	12	19.6
Total	61	75.30

Table VI shows that teeth involved in fracture line were 75.30% of mandibular fractures. The most common tooth involved was the cuspid (22.95%) followed by the third molar (19.6%). It was not always possible to determine which tooth was involved in the fracture line on conventional views.

Table VII  
Classification according to the dentition and degree of displacement observed on OPG

Type of fracture	No. of fracture lines	Degree of displacement		
		Undisplaced	Minimally displaced	Considerably displaced
Class I	53 (65.43%)	14	26	13
Class II	13 (16.00%)	0	07	06
Class III	0	0	0	0
Total	66 (81.47%)	14 (17.28%)	33 (40.74%)	19 (23.45%)

Table VII shows that the amount of displacement in the form of separation or overriding of the fragments was more clearly visible on panoramic X rays as compared to conventional radiographs.

According to the status of dentition and location of fracture lines, mandibular fractures were classified and the commonest type found was class I (65.43%).

Class I: Teeth present on both sides of the fracture line

Class II: Teeth present on one side of fracture line

Class III: No teeth present on either side of the fracture line

# LEGENDS



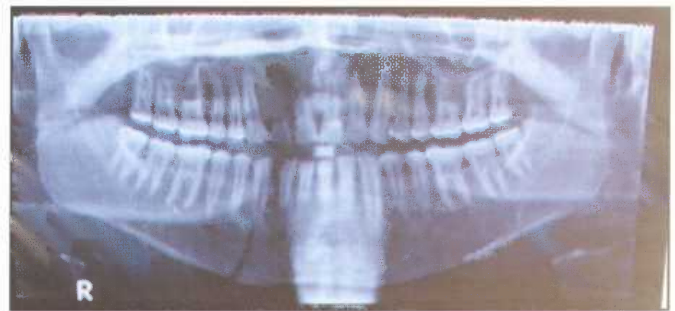
Symphysis fracture not visible in OPG (Fig.1)



PA Veiv of mandible showing fracture symphysis (Fig.2)



OPG Showing fracture symphysis region of mandible (Fig.3)



OPG showing fracture Rt parasymphysis region of mandible (Fig.4)



OPG showing fracture Rt. body & Left angle region of mandible (Fig.5)



OPG showing fracture symphysis & left coronoid process of mandible (Fig.6)



OPG showing fracture bilateral condylar region of mandible (Fig.7)

## DISCUSSION

The mandibular fractures are the common facial injuries and their treatment is one of the most frequent forms therapy provided by the oral and maxillofacial surgery.<sup>11,13</sup>

The routine radiographic examination in case of fractured mandible requires several radiographic views which necessitate more manipulation of patient causing more discomfort and an increased radiation exposure of the patient. It is occasionally inadequate to reveal the fracture of mandible at various sites. Moreover, such radiographs require high skill and an experienced operator. Gray et al (1986)<sup>5</sup> found 40% diagnostic error when routine radiographs alone were used for the diagnosis of fractures of mandible in a series of 512 patients.

Currently panoramic radiography, a type of body sectional tomography, is becoming more popular amongst the oral surgeons to detect fractures of mandible, as it provides broader coverage of image area of facial bones including all the teeth of both the arches alongwith their supporting tissues and the entire mandible from right to left including condyles on a single x-ray film. Also there is minimum discomfort and reduced radiation exposure to the patient with an added advantage of being less time consuming and cost effective. In this way panoramic radiography also covers all the drawbacks and limitations of routine radiographic technique.

The present study included 50 patients who had clinical evidence of fractured mandible. After taking relevant history and performing clinical examination, provisional diagnosis was made. The required routine extraoral radiographs were taken. For all the patients, panoramic radiographs were taken with a single exposure on Panex 100 EC Unit.

In this study it was found that the incidence of fracture of the mandible was highest in the third decade followed by the fourth decade of life and the majority of fractures occurred in young male patients.<sup>11,13</sup>

In our study out of 50 patients male to female ratio was 11.5:1.

In our study a ratio of number of fractures to number of patients was 1.62:1 which indicated that the multiple fractures of the mandible were not infrequent and during the examination this was taken into into consideration. Moilanen (1984)<sup>9</sup> found the similar ratio of number of fractures of the mandible to number of patient as 1.89:1.

It was seen that the road side traffic accidents accounted for the largest number of fractures and assault were found to be the next most common cause of the maxillofacial trauma.<sup>1,10,13</sup>

In this study fractures of the symphysis and parasymphysis regions of the mandible were the most common (49.38%) followed by condyle (17.26%), angle (16.04%), body (14.81%), ramus (1.23%), coronoid process (1.23%).

Another advantage of panography over routine extraoral technique is elimination of superimposed images of the intervening structure as structure in the selected plane is distinctly recorded Goaz, White (1982)<sup>4</sup> and Updegrave (1966)<sup>14</sup>.

Panoramic radiography simplifies this problem as both the temporomandibular joints can be examined on the single OPG without superimposition.<sup>6,7</sup>

In the present, out of clinically evident 81 fractures of the mandible, 80 were detected "with full extent" on the orthopantomogram. Thus OPG gives 98.77% reliability of OPG in detecting fractures of the mandible and proves it to be superior to conventional radiographs. The fracture of the symphysis region that was not visible in one OPG (Fig. 2) was probably due to

the superimposed vertebral column, narrow arch of rotation in the anterior region and chin rest shadow which can be avoided by altering the position of the patient, keeping the occlusal plane slightly at a lower level instead of parallel to the floor when the patient is in standing position (fig 1 and 2). So in the present study in 39 out of 40 patients the symphysis and parasymphysis fractures were clearly visible (Fig.3 & Fig.4) in contrast to conventional X-rays in which reliability was 36 out of 40. Other fractures like that of body and angle (Fig.5), coronoid process (Fig.6) and condylar region were also visible with full extent on OPG in the present study.

It is not always possible to determine the exact relationship of teeth with the fracture line on conventional views. In the present study, the OPG had demonstrated the teeth involved in the fracture line more clearly which helped in taking the decision whether the presence of tooth in the fracture line would aid in reduction or whether it should be extracted as it may cause hindrance in the union of the fractured segments.<sup>12</sup>

Most common tooth found to be involved was mandibular cuspid (22.95%) which is in the anatomically weak region of mandible followed by the third molar.

In the present study 65% of the fracture belonged to class I category (teeth present on both the sides of the fracture line) as shown in table V.

In medicolegal cases, complete evaluation of the patient is needed, hence in such cases radiological evidence and complete tracing of the fracture lines are essential. The addition of panoramic radiograph will enhance the accuracy in diagnosis of fracture of the mandible. Single OPG can obviate the need for the other routine radiographs and can be used as a reliable means of record.

Moilanen (1984)<sup>9</sup> further observed that panography is not so reliable for detection of midface bone fractures as it is for the mandibular fractures as the outline of the mandible is parabolic in shape whereas the outer surface of the midfacial skeleton is cylindrical in shape. More recently, cylindrical image layer has been incorporated in OPG unit for midfacial skeletal fractures. This has opened a new era in the field of diagnosis of midface fractures.

Though the exposure time of 15 sec for the OPG is long, most of the patients with maxillofacial injuries remained still during this period, due to easy, comfortable positioning required to obtain good OPG. Panoramic zonography is a new development in panoramic radiography which has the ability to examine injured and uncomfortable patients in the supine position.<sup>2</sup>

The fracture of facial skeleton in which the CT examination is valuable includes those associated with facial injuries and intracapsular condylar fractures of mandible which are not visible in plane film. Thus CT does not give any additive advantage in fractures of mandible other than condylar fractures over plane x-rays or OPG.<sup>3,13</sup>

Thus it is true that the diagnosis, treatment planning and management of the fracture are greatly facilitated by OPG as it is more accurate and reliable. In addition to being time and cost effective, preference of OPG over conventional radiographs in cases of mandibular fracture by an oral surgeon can be easily understood if one reflects upon the importance of information offered by OPG which will help him in the successful management of the patients with the mandibular fractures.

#### Summary and conclusion

The proper radiographic evaluation is essential to confirm the presence and

location of mandibular fractures. The use of orthopantomography in the present study has proved it to be a most valuable technique to diagnose the mandibular fractures more accurately and reliably.

Fifty patients with clinical evidence of fracture mandible were selected and conventional mandibular radiographs and single OPG were taken for each patient.

All the patients were in the age group of 18-50 years. The highest incidence of mandibular fractures was seen at the third decade of life followed by the fourth decade. Males were more affected than females giving a male to female ratio of 11.5:1.

Road traffic accidents accounted for the majority of the fractures (72%) followed by assaults (18%), fall (4%), sports related accidents (4%) and other causes (2%). The symphysis and parasymphysis region were the most common sites involved (49.38%) followed by condyle (17.28%), angle (16.05%), body (14.81%), ramus (1.24%) and coronoid process (1.24%).

On panoramic radiographs all fracture lines except one were visible "with full extent" giving a diagnostic error of only 1.2% while on conventional views two fracture lines out of 81, were "not visible" giving a diagnostic error of 2.5%.

Teeth involved in the fracture line were more clearly visible on OPG than on conventional radiographs and the most common tooth involved was the cuspid (22.95%) followed by the third molar (19.6%).

OPG has also been found superior to conventional series in estimating the degree of displacement of fractured segments. The commonest type found was class 1 (65.43%) of the mandibular fracture according to the status of dentition and location of the fracture line.

Fracture of ramus and coronoid process which were not visible on conventional mandibular radiographs were visible with full extent on OPG.

#### CONCLUSION

Hence it can be concluded that the diagnostic accuracy of OPG was 98.77% in detection of mandibular fractures. Orthopantomography is superior to the conventional radiography in diagnosis and treatment planning of fractured mandible and should substitute the conventional extra oral radiographs.

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