

## Original paper

# Diagnostic accuracy of panoramic maxillary sinus projection in patients with maxillary bone fractures according to CT scan findings

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## Abstract

**Background:** Diagnostic imaging has been of recent and unique importance in substantiating the clinically suspected existence of the midface fracture and it is essential to be aware of the various procedures available to help initially in establishing an accurate diagnosis. The aim of the study is to evaluate the diagnostic accuracy of panoramic maxillary sinus projection according to computed tomographical findings in patients with maxillary bone fractures to be used as an emergency radiographic diagnostic aid.

**Subjects, material and methods:** Thirty patients with a midfacial trauma and twenty patients suspected to having midfacial fractures. All subjects were examined radiographically using panoramic maxillary sinus imaging system to evaluate the maxillary bone and recorded as either “positive” or “negative” according to the positive computed tomographical maxillary bone fracture findings.

**Results:** Panoramic maxillary sinus projection was 87.5% sensitive in detecting maxillary bone fractures line with 96% accuracy and it can establish the diagnosis of any maxillary bone fracture with 100% confidence in any clinical setting.

**Conclusion:** If panoramic maxillary sinus imaging is performed as the first imaging modality in case of suspected midfacial fractures by an experienced investigator, the visualization of fracture line can avoid conventional imaging, so that only an indicated computed tomography scan can be added.

**Keywords:** maxillary bone fracture, dental panoramic, computed tomography.

## Introduction

Despite society's ever-increasing concern for personal safety, trauma to the facial bones and enveloping soft tissue remains a relatively common occurrence<sup>(1)</sup>.

Diagnostic imaging has been of recent and unique importance in substantiating the clinically suspected existence of the midface fracture and it is essential to be aware of the various procedures available to help initially in establishing an accurate diagnosis<sup>(2)</sup>. Radiologists must be committed to dose reduction and should educate their patients and referring

physicians about the radiation dose and alternative imaging choices<sup>(3)</sup>.

Panoramic radiographs are tomographic images in which the slice of tissue image is curved to conform to the shape of the dental arches<sup>(4)</sup>; it is useful in dentistry, otolaryngology<sup>(5)</sup> and facial surgery<sup>(6)</sup>.

With panoramic radiography it is possible to detect radiological changes outside the dentoalveolar region<sup>(7)</sup>, especially in the maxillary sinuses<sup>(8, 9)</sup>. Modern equipment can often limit the examination to areas of particular interest such as the maxillary sinuses and orbits<sup>(4)</sup>.

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## Subject, Materials And Methods

Total of 50 patients (38 male and 12 female), whose age range from 18 to 62 years old presented with a variety of facial injuries. Thirty patients with a midfacial trauma (60%) of all patients and twenty patients with a trauma subjected to the whole patient's bodies and suspected for midfacial fractures. All subjects had a computed tomographical examination (figure 1), and panoramic maxillary sinus imaging system (OPG/M) (figure2).

All images were examined and its result were recorded as either "positive" or "negative" according to the positive computed tomographical midfacial fracture findings, and other indirect signs of fracture if present (Hematoma of the maxillary sinus and emphysema). The results were analyzed by various statistical testing methods (for sensitivity, specificity, positive predictive value, and accuracy).

## Results

As shown in table (1), the OPG was 87.5% sensitive in detecting fracture line i.e. it was associated with false negative test results in 12.5% of cases. The test was 100% specific with no false positive test results i.e. it can establish the diagnosis of fracture maxilla with 100% confidence in any clinical setting. A negative test result can exclude fracture maxilla with 98.6% confidence in a clinical setting with 10% pretest probability and 88.9% confidence for a setting with 50% pretest probability of maxillary fracture.

## Discussion

The present study revealed that road traffic accident was the predominant etiological factors for facial injuries and that was agreed with **Saeed, (2001)**<sup>(10)</sup>. They have a high incidence of associated facial fractures with a percentage of (52%), It was obvious that injuries that

were sustained by road traffic accident were the most serious and reflect with other corresponding study done by **Haug and Foss (2006)**<sup>(11)</sup> importance of using seat belts and lower speed limits. The second etiological factor for facial injuries was violent trauma (16%) 8 cases, most of violent trauma causing zygomatic fractures and that agree with **El-Alami (2003)**<sup>(12)</sup>. Sport trauma was responsible for 6 cases (12%). Sport trauma sometimes may responsible for serious injuries to the nasoethmoidal complex<sup>(13)</sup>. Fall from height recorded only 2 cases (4%), and this was close with what reported (5%) by **Douglas Sinclair et al, (1988)**<sup>(14)</sup>. One rare case was young patient subjected to high trauma caused by falling of wall affecting his face which reported (2%) of cases.

In the present study the OPG was 87.5% sensitive in detecting maxillary bone fractures and it was associated with false negative test result in 12.5% of cases, and that result may be related to distortion and disruption of an already complex anatomical bony framework by gross swelling usually from edema and bleeding into the tissue which accompanied extensive fractures.

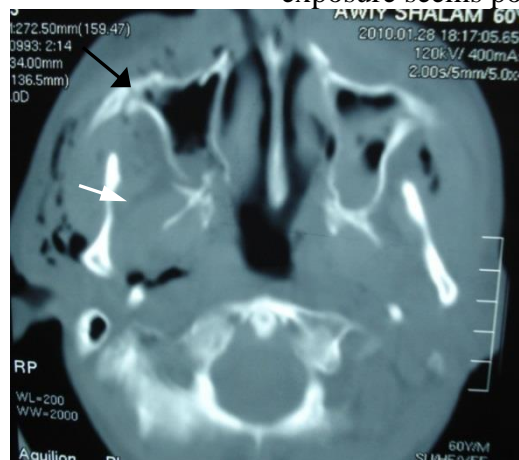
That result was disagreed with **Moilanen, (1984)** in which the sensitivity of OPG in that area was 65%. The test was 100% specific with no false positive test result and can be used to diagnose maxillary bone fracture in 100% confidence in any clinical setting. That in perfect agreement with **Moilanen (1984)** result (100% specific) but he used a small sample.

**Moilanen, 1984**<sup>(16)</sup> indicated that panoramic radiograph is useful for the diagnosis of the dentoalveolar area of the maxilla and consider it as an unreliable for the evaluation of midfacial fractures and may lead to misinterpretation, but recommended to use new panoramic devices to abolish his study deficiency by altering the guiding profile.

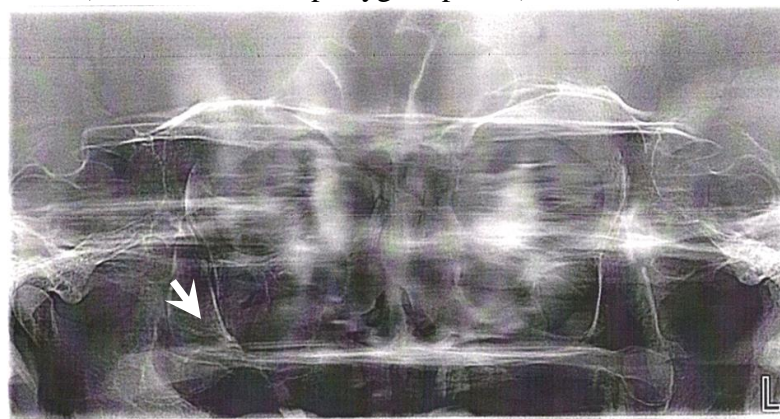
The present study, in addition to CT scan, the diagnostic sensitivity and specificity of the panoramic radiography (by using a new technical guiding profile maxillary sinus view) was used in detection of midfacial fractures to be used as an emergency radiographical aids because todays digital panoramic radiograph is reliable procedure that if combined with practice management, software enables the dentist to extract more information from the same image than ever achievable with film.

### Conclusions

If Panoramic maxillary sinus images is performed as the first imaging modality in case of suspected facial fractures by an experienced investigator, the visualization of fracture line can avoid conventional imaging, so that only an indicated CT scan can be added. In doubtful cases, an individual combination of conventional radiographs would be the next step. By this, an overall reduction of radiation exposure seems possible.



**Figure 1.** Axial image showing fracture anterior wall of maxillary sinuses (black arrow), and fracture of pterygoid plate (white arrow).



**Figure 2.** Panoramic Maxillary sinus view showing fracture maxilla (white arrow).

**Table 1.** Sensitivity and specificity of OPG in fracture maxilla

Fracture Maxilla-OPG	Fracture Maxilla-CT			Sensitivity	Specificity	Accuracy	NPV at pretest probability=	
	Absent	Present	Total				50%	10%
Absent	34	2	36	87.5	100.0	96.0	98.6	88.9
Present	0	14	14					
Total	34	16	50					

## References

1. Seth R, Thaller W, Scott McDonald. Facial trauma University of Miami School of Medicine Miami, Florida, U. S. A. © MARCEL DEKKEK, INC 2004; p: 5.
2. Al- Rekaby R. Spiral computed tomography scan for temporo-mandibular joint bony disorders. Master thesis of Science in Oral and Maxillofacial surgery submitted to the College of Dentistry/University of Baghdad 2003; p: 1.
3. Martin Diego R and Semelka Richard C. Health Effects of Ionizing Radiation from Diagnostic CT Imaging: Consideration of Alternative Imaging Strategies. Applied Radiology. Anderson Publishing, Ltd. © 2007; 36(6).
4. Williams Jli. Rowe and Williams Maxillofacial injuries, 2nd Ed., volume 1, Churchill Livingstone 1994; p162-166.
5. Ohba T, and Katayama H. Comparison of panoramic radiography and water's projection in the diagnosis of maxillary sinus disease, Oral surgery 1976; 42:534-538.
6. Schaffer A.W. The panoramix in oral surgery. Oral surg. 1967; 24:359-363.
7. Lehtinen R, Aitasalo K. An orthopantomographic study of the incidence of pathological changes in the jaw outside the dentoalveolar area, Proc Finn Dent Soc 1973; 69:13-16.
8. Lyon H.E. Reliability of panoramic radiography in the diagnosis of maxillary sinus Pathosis. Oral surg. 1973; 35:124-128.
9. Ohba T. Value and limitation of Panoramic Radiography in the Diagnosis of maxillary sinus Pathosis, Int. J oral surgery 1977; 6:211-214.
10. Saeed Ibrahim G. The use of computerized tomography in the diagnosis of facial fractures, scientific council of maxillofacial surgery. Baghdad 2001;p45
11. Haug R H and Foss J. Maxillofacial in the pediatric patient. Oral Surg. Oral Med Oral Pathol. Radiol Endod 2000; 90:125-134.
12. El-Alami N. Therapeutic evaluation of zygomatic complex fractures, A master thesis Science in Oral and Maxillofacial Surgery submitted to the College of Dentistry/University of Baghdad 2003; p66-70
13. Covington D S, Wain Wright D J, Teichgraeber J F., Parks D.H. Changing Pattern in the epidemiology and treatment of zygoma fractures 10 yrs. review. The journal of trauma 1994; 37:243-50.
14. Douglas Sinclair, Micheal Schwartz, Joseph Gruss, Barry McLellan. A retrospective review of the relationship between facial fracture, head injuries, and cervical spine injuries. J of emergency medicine 1988; 6:109-112.
15. Werner H, Shintaku, Japueline S, Venturin, Bruno Azevedo, Marcel Noujeim. Applications of cone-beam computed tomography in fractures of the maxillofacial complex. Dental traumatology 2009; 25: 358-366.
16. Moilanen Aimo Midfacial fractures in dental panoramic radiography. Oral surg Oral med Oral patho 1984; Jan: 57:106-10.