Diagnostic accuracy of panoramic maxillary sinus projection in patients with midface 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 midface 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 nasal, orbital, maxillary, and zygomatic bone and recorded as either “positive” or “negative” according to the positive computed tomographical midfacial fracture findings.

Results: Panoramic maxillary sinus projection was 83.3% sensitive in detecting midfacial fractures line with 90% accuracy and it can establish the diagnosis of any midfacial bones 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.

Key words: midfacial 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 (1). 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 (2). Radiologists must be committed to dose reduction and should educate their patients and referring physicians about the radiation dose and alternative imaging choices (3).

Panoramic radiographs (orthopantomograms or OPG films) are tomographic images in which the slice of tissue image is curved to conform with the shape of the dental arches (4), it is useful in dentistry, otolaryngology (5) and facial surgery (6).

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

MATERIALS AND METHODS
Total of 50 patients (38 male and 12 female), whose age rang from 18 to 62 years old, presented with a variety of facial injuries based on clinical signs and symptoms of facial fracture and computed tomographical examination (CT), they were collected from the first of October 2009 till the first of April 2010, 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) (figure 2).

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
Panoramic maxillary sinus images agree with computed tomography in 72% (36/50) of study cases. In the remaining cases 28% OPG/M always under estimates the real number of fracture shown by CT. OPG/M never overestimates the number of fracture lines in midfacial fracture cases. Out of the 25 cases with no fracture on OPG/M, 4 cases
was with one fracture line and the remaining were with 2 fracture lines on CT. Among 15 cases with fracture line on (OPG/M) 6 had 2-3 fracture lines on CT. Subjects with 3 to 4 fracture lines were in perfect agreement with CT. (table 1).

The (OPG/M) was 83.3% sensitive in detecting midfacial fracture line (16.7% false negative OPG/M result). OPG/M was 100% specific with no false positive test results i.e. it can establish the diagnosis of any midfacial bones fracture with 100% confidence in any clinical setting.(table 2).

DISCUSSION

The present study revealed that road traffic accident was the predominant etiological factors for facial injuries and that was agreed with Saeed (10). 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 (11) 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 (12). Sport trauma was responsible for 6 cases (12%). Sport trauma sometimes may responsible for serious injuries to the nasoethmoidal complex (13). Fall from height recorded only 2 cases (4%), and this was close with what reported (5%) by Douglas Sinclair et al (14). One rare case was young patient subjected to high trauma caused by falling of wall affecting his face which reported (2%) of cases.

As shown in table 1, OPG/M in the present study agrees with CT in 72% (36/50) of studied cases. In the remaining cases 28% the OPG/M always under estimate the real number of fracture shown by CT. The OPG/M never overestimate the number of fracture line in midfacial cases.

Its obviously that subject with 3 to 4 fracture lines have a higher agreement with CT than subject with 0 to 2 fracture lines.

The cause could be due to high traumatic force that cause these increasing in fracture line make them more obvious by OPG/M than 0 to 2 fracture lines caused by relatively low traumatic force.

In midfacial fracture, the OPG/M have an overall sensitivity of 83.3% and that mean it have a 16.7% false negative test result and a specificity of 100% table 2, that mean OPG/M can make a diagnosis with 100% confidence in any clinical setting to describe the type of fracture and the nature of its dislocation CT scan are usually required (15). By this, an overall reduction of radiation exposure seems possible.

Moilanen 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. (16)

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 today's 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.

Figure 1: Axial image showing fracture anterior wall of maxillary sinuses (black arrow), and fracture of pterygoid plate (white arrow).
Diagnostic accuracy of panoramic oral diagnosis

Figure 2: Panoramic Maxillary sinus view showing fracture nose (short black arrow), orbit (long black arrow) and maxilla (white arrow).

Table 1: Agreement of OPG/M with CT

<table>
<thead>
<tr>
<th>Count of mid face bones with fractures- OPG/M</th>
<th>Count of mid face bones with fractures-CT</th>
<th>Total</th>
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<tbody>
<tr>
<td>0</td>
<td>20</td>
<td>41</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
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<td>2</td>
<td>0</td>
<td>21</td>
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<td>3</td>
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<td>41</td>
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<tr>
<td>4</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
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</table>

Kappa = 0.59 P<0.00

Table 2: Sensitivity and specificity of OPG in midfacial fracture

<table>
<thead>
<tr>
<th>Mid face fracture-OPG/M</th>
<th>Mid face fracture-CT</th>
<th>NPV at pretest probability=</th>
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</thead>
<tbody>
<tr>
<td>Absent</td>
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<td>Sensitivity</td>
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<tr>
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<td>Present</td>
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</tr>
<tr>
<td>Total</td>
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REFERENCES

