International Journal Of

Recent Scientific Research

ISSN: 0976-3031
Volume: 7(6) June -2016

"EVALUATION OF RADIOGRAPHS, CT AND 3D REFORMATTED CT IN MAXILLOFACIAL TRAUMA" – A COMPARATIVE STUDY

Mastan Shaik., Vamsi Krishna Reddy and Sasthrulu G.V.N.B.R

THE OFFICIAL PUBLICATION OF
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH (IJRSR)
http://www.recentscientific.com/ recentscientific@gmail.com

ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 7, Issue, 6, pp. 11817-11821, June, 2016

International Journal of Recent Scientific Research

Research Article

"EVALUATION OF RADIOGRAPHS, CT AND 3D REFORMATTED CT IN MAXILLOFACIAL TRAUMA" – A COMPARATIVE STUDY

Mastan Shaik., Vamsi Krishna Reddy and Sasthrulu G.V.N.B.R

St. Joseph Dental College and Hospital, Duggirala, Eluru, West Godawari District, Andhra Pradesh, India

ARTICLE INFO

Article History:

Received 17th March, 2016
Received in revised form 21st April, 2016
Accepted 06th May, 2016
Published online 28th June, 2016

Key Words:

CT –Computed Tomography, 3D CT, 3D imensional Computed Tomography.

ABSTRACT

AIM: To comparatively evaluate the maxillofacial trauma patients using plain radiographs, CT scan and 3D reformatted CT.

Materials and methods: Ten patients who sustained multiple maxillofacial fractures were randomly selected for this study irrespective of age and sex. In all these cases, conventional plan radiographs, Computed tomography, 3Dimensinal CT were taken and evaluated for diagnosis and better treatment plan.

Results: The results of this study suggest that orbital trauma especially fractures of lateral, medial and inferior orbital wall, orbital muscle/fat entrapment were clearly visualized on CT scan. The displacement and communication of the zygomatic complex clearly appreciated in 3dimensinoal imaging of CT, Posterior extension of LeFort groups of fracture specifically the fracture of medial and lateral pterygoid plates were seen on CT scan.

Conclusion: During the course of present study, the CT, 3D CT was found to be standard in radiological investigations include assessment of, accuracy and extension of fracture in maxillofacial trauma. Whereas conventional radiographs have limitation in accuracy and extension of fracture. They seem to be an easiest to read 3D CT image, it become superior or higher radiological investigation for diagnosis and better treatment outcome.

INTRODUCTION

The evaluation of the trauma of the facial skeleton is based on clinical examination followed by the appropriate radiographs. Plane radiography has been used successfully for many years but advanced imaging methods such as CT and 3-D CT have been applied more recently. Conventional X-rays are relatively sensitive to cranial vault fractures, but insensitive to fractures of the skull base and facial skeleton. Conventional X-rays of the skull are no longer used in the case of head traumas or polytraumatized patients. Surgeons frequently need to make their own evaluation of the degree of skeletal disruption revealed by imaging studies when planning initial treatment of facial fractures. 3D images reformatted from CT offer a subjectively attractive medium for displaying skeletal lesions and the technique has attracted interest in the management of patients with facial trauma[1]. High resolution computed tomography including three dimensional reconstruction have been increasingly used to evaluate patients with blunt facial trauma since it depicts both osseous and soft-tissue defects including even the hairline fractures of the facial skeleton which often get undiagnosed in routine examination[2].

CT enables a precise diagnosis of all kind of fractures of the facial skeleton and skull base, and additionally delivers information about intracranial bleeding and injuries to the cerebrum. In the multi-traumatized patient, CT can be extended to the cervical spine as well as the trunk if necessary.

CT is widely accepted as the primary imaging method of choice. CT is an X-ray imaging method where the X-ray source rotates around the patient, giving information about the density of the tissues (attenuation profiles) in the slice within the X-ray beam. The attenuation profiles of the slice are Fourier transformed into a matrix of digital values representing a digital image of the slice. Every pixel of the image represents a small volume element (voxel) in the patient.

Facial injuries are clinically significant because they are often complex in nature and may have serious functional and cosmetic sequelae. This makes accurate diagnostic evaluation essential. Modern imaging modalities, especially CT, have

**Corresponding author: Mastan Shaik*
St. Joseph Dental College and Hospital, Duggirala, Eluru, West Godawari District, Andhra Pradesh, India

been shown to be value in the assessment and management of acute facial trauma. One of the important factor determining the success of treatment of midfacial fractures is early and correct diagnosis.

The evaluation of the trauma of the facial skeleton is based on clinical examination followed by the appropriate radiographs. Plane radiography has been used successfully for many years but advanced imaging methods such as CT and 3D CT have been applied [1, 2, 3].

Blunt facial trauma is often accompanied by mechanisms that indicate a need for brain imaging to evaluate for injury. Physical examination, 3-view facial series, single-view facial radiography, and computed tomography (CT) of the face are all methods for determining the presence of facial fractures in blunt trauma patients. Each of these methods has limitations. Physical examination often hindered by pain, soft tissue swelling, lacerations, and altered mental status. Facial radiography is limited by interpretation difficulties by nonradiologists and has a lower diagnostic utility as compared with facial CT[4].

The goals of this study were to correlate the clinical and radiological findings and also to compare the efficacy of CT and 3D CT with that of conventional radiography in diagnosis of maxillofacial fractures and early detection of associated cerebral trauma, for better understanding of the fracture pattern and related soft tissue injuries. CT will contest the gold standard in evaluation of facial injuries[3-4].

The study was conducted in the Department of Oral and Maxillofacial Surgery, St.Joseph Dental College, Duggirala, Eluru. Ten patients who sustained multiple maxillofacial fractures were randomly selected for this study irrespective of age and sex. In all these cases, conventional plain radiographs, Computed tomography, 3Dimensinal CT were taken and evaluated for diagnosis and better treatment plan.

Inclusion criteria

1. Patients who sustained maxillofacial injuries irrespective of age and sex.
2. Patients who require higher imaging techniques for diagnostic purpose.

Exclusion criteria

1. In patients where CT is contraindicated
2. Maxillofacial trauma patients who does not require high imaging technique for diagnostic purpose.

MATERIALS

The following materials were used in the study

- Conventional radiographs.
- Computer tomography.
- 3 Dimensional CT.

METHODOLOGY

Conventional radiography

A radiographic examination for the cranio-facial complex was performed for all cases followed by routinely and according to the needs of each individual case. The extra-oral projections included submento-vertex, reverse Town's, Postero-anterior, Water's view, Orthopantamogram, panoramic, trans-pharyngeal, lateral oblique and true lateral views. For the unconscious patients these views were taken either on the radiographic table or supine position or after the patient recovery.

Computed tomography

The CT examination was performed on the Siemens B 30B (spiral rotating system) at settings of 120-137 kVp, 330 – 500 mA and 512X512 reconstruction matrix. The examination was performed in axial and coronal scans on a bone window basis.

3Dimensional CT

3D facial reconstruction CT unit used in this study Siemens of whole body scanner. The slice thickness used in this study ranges from 2mm to 6mm. continuous volume scan was taken in axial, coronal and saggital plane, which makes an image of three dimension or a 3d reconstruction. The spiral scan cycle time was approximately 34 seconds.

The advent of three-dimensional (3-D) CT reformatted images constructed from routine two-dimensional (2-D) CT in axial and coronal planes adds a new dimension to the evaluation of maxillofacial trauma.

Patients with maxillofacial injuries will be subjected to plain radiographs, CT, 3D CT. Assessment of these 3 techniques and a comparative evaluation is done for better diagnostic purpose. For all patients a standard viewing format was created by transferring all images to high resolution VHS (***Volume Helical Shuttle)*** video tape. The selected CT sections were individually recorded to display of bony structures.

3D reformatted CT images were recorded directly from the unit and displayed in frontal view in rotating frame over 180°, in 3 increments. All these three techniques provide sufficient information for four purposes: diagnosis, assessing the extent of fracture, predicting complications and planning surgery.

This study was done in the department of oral and maxillofacial surgery, St.Joseph Dental College, Eluru, on a sample size of 10 patients with irrespective of age and sex who sustained fractures of maxillofacial trauma. All the Patients underwent radiological investigations (plain radiographs, Computed Tomography, 3Dimensional CT) diagnosed for better outcome of treatment plan.

The following observations using 3 techniques

A total 10 patients were included in the present study.

All the patients were males and the most common cause of injuries were road traffic accidents, Out of 10 patients, 8 patients were conscious at the time of injury, 2 patients are unconscious.

The displacement and communication of the zygomatic complex clearly appreciated in 3dimensinoal imaging of CT, Fracture of nasal septum and also the comminution of the anterior, middle and posterior lateral walls of the maxillary sinus with the presence of air fluid level (blood) were evident on CT.

Armamentarium

A. Opg Machine

Fig 1

B Ct Scanning Machine

Fig 2

C Conventional X-Ray

Fig 3

D Ct Film

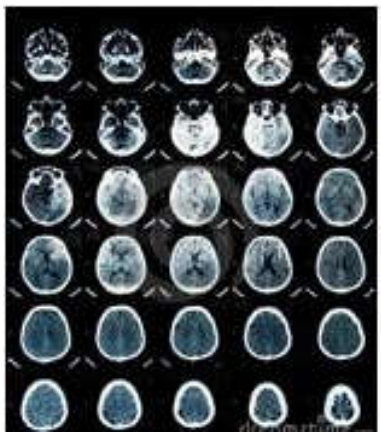

Fig 4

E 3D CT Image

Fig 5

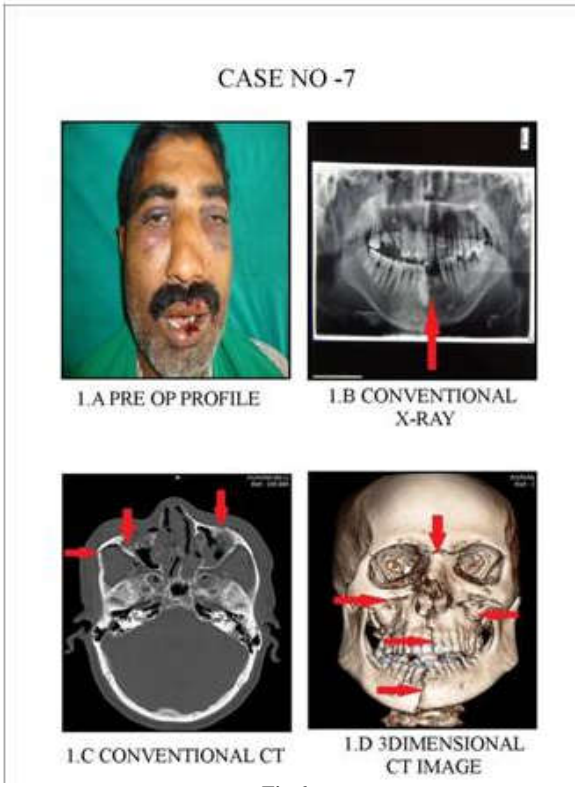

Fig 6

Posterior extension of Lefort group of fractures specifically the fracture of medial and lateral pterygoid plates were seen on CT scan.

In case no 1,2,3 5 & 9 there is no clear evidence of fracture, can be appreciated at maxillary sinus region, as the same patients gone for higher imaging techniques CT and 3DCT, they showed clear evidence of fracture, muscle and fat entrapment into maxillary sinus in conventional axial section and 3D CT.

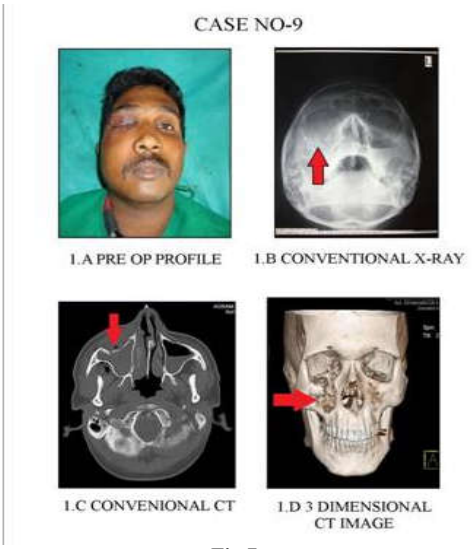

Fig 7

Case	Diagnosis of fractures established by 3 techniques imaging methods.	Conventional Radiography	Computed Tomography	3D CT
1	Zygomatic arch Infra orbital rim Parasymphysis eal Maxillary sinus Subcondyle	+ + + _ +	_ + + + +	+ + + + +
2	Zygomatic arch Frontozygomati c suture Maxillary sinus	+ + _	+ _ +	+ + +
3	Zygomatic buttress Nasal septum	+ _ _	+ + +	+ + +
4	Supra orbital rim Infraorbital rim Zygomatic buttress Maxillary sinus Nasal bone	_ _ + + _	_ _ + + +	+ + + + +
5	Zygomatic arch Frontozygomati c suture Maxillary sinus Zygomatic buttress	_ + _ +	+ _ _ _	+ + + +
6	Nasal bone Parasymphysea l	_ +	+ +	+ +
7	Frontonasal suture Zygomatic arch Infra orbital rim Zygomatic	- - - - -	- + + + -	+ + + + +
8	Fontal bone, Frontal sinus Mid palatal split Maxilla Zygomatic buttress Frontozygomati c suture Symphysis	- - - - - - -	- + - + - - +	+ + + + + + +
9	Infraorbital rim Infra orbital foramen Maxillary sinus	+ - -	+ - +	+ + +
10	Parasymphysis Subcondyle	+ +	+ +	+ +

Table 1 The fracture sites as detected by conventional radiographs computed tomography or 3 dimensional CT

(+) Detected (-) Not detected

Adequate finding of nasal bone fractures are not clearly appreciated in conventional radiographs in case no 4, 5, & 6 cases where as same fracture is visualized in conventional computed tomography and 3 dimensional CT.

Presence of contusion over the face, bad interpretation of fractures of maxillary sinus wall zygomatic buttress region, in case of 1,2,3,5, & 9, has interpreted with advance methods (CT & 3D CT).

Conventional x rays has disadvantage of diagnosing, facial edema or contusion over the face and interpretation of maxillary sinus wall, zygomatic buttress fractures.

In our study we found that especially orbital fracture of lateral, medial and inferior orbital wall and also blow out fractures with orbital muscle/fat entrapment were clearly visualized on CT scan, whereas in conventional radiographs failed to explode the orbital fractures.

DISCUSSION

This study demonstrates that surgical viewers to find 3D reformatted images to be greatest clarity and easiest to interpret the available imaging modalities in facial trauma. The 3D images are of greatest benefit for the assessment of mid-face injuries, although they recognized that disparity between those who reported the images to be useful (97%) compared with those who modified their diagnosis (28%) was large.

Tanrikulu and Erol *et al* Computed tomographic scanning to be the most accurate method of detecting midfacial and orbital fractures as compared with plain radiography and physical examination of the face.

CT is superior to conventional methods for the diagnosis of zygoma fractures for two reasons; first, since the exact diagnosis of displacement of five major articulations of the zygoma can be evaluated better with CT, it facilitates the selection of the best surgical approach; second, depression of zygomatic arch may trap the coronoid process of the mandible CT is superior to conventional radiograph for imaging the frontal process of maxilla, pterygoid plate fractures and comminuted fractures of the maxillary sinus walls.[3]

Tabulation of fractured surfaces without assistance of plain films provides some measure of differential sensitivity between the two methods. CT identified more fractures than did PT (pluridirectional tomography). CT exclusively defined lateral and medial orbital wall fractures many more times than PT, The medial orbital wall fractures were nearly always accompanied by hemorrhage or soft-tissue swelling in the ethmoid sinuses. The improved contrast resolution of CT allows for good differentiation between ethmoid wall and blood in maxillary sinus, anterior wall fractures were demonstrated exclusively by CT eight times.

An additional advantage of CT is its ability to demonstrate soft-tissue injury. In two studies, about one-third of the patients had intracranial injury demonstrated by CT. [5]

The fractures of the mandibular condyle are better appreciated in sagittal plane, while 3-D reconstructions are extremely useful in planning surgical management.[6]

According to **usama *et al*** in Fractures of zygoma, CT will easily demonstrate any posterior displacement (at the axial plane) and or rotation of the body/arch of the zygoma. The amount of mediolateral displacement of the zygoma, lateral wall of the maxillary sinus, floor/lateral orbital wall, are best assessed by CT in the coronal section[7].

The CT scanner has often several advantages such as early diagnosis when the facial edema, sever laceration and altered consciousness may limit a good clinical examination and affect the treatment plan. It was founded in this study that (5mm) slice thickness is sufficient for CT imaging of a patient with facial trauma even in severe trauma or imaging of complex anatomical area like the orbit, nasoethmoid or maxillary bones. These results disagree with other researcher who recommended a thin slices (2-3mm), therefore this will decrease the time of scanning and the risk of radiation[8].

Denise Takehana dos santos *et al* demonstrate and concluded the sensitivity and specificity of multislice computed tomography (CT) for diagnosis of orbital fractures, and our study showed 100 % of evidence in orbital trauma especially fractures of lateral, medial and inferior orbital wall and also blow out fractures with orbital muscle/fat entrapment. Posterior extension of Lefort groups of fracture specifically the fracture of medial and lateral pterygoid plates were seen on CT scan[10].

CONCLUSION

This study demonstrated the valuable role of 3D CT in the evaluation of maxillofacial fractures. The advantages of CT and 3D images include assessment of accuracy and extension of fracture in the maxillofacial region. The easier detection of frontal and maxillary bones as well as their displacement in patients with complex midface fractures could be described. The coronal reconstructed images are superior in the detection of fractures in the orbit and maxilla. 3D images have a limited role in fracture involving the naso-orbital, naso-ethamoid region and also when there is minimal fracture displacement. We can appreciate soft tissue injuries in provided soft tissue window in CT scan. Though CT is time consuming technique, it become superior or higher radiological investigation for better treatment outcome, as we can't justify the accuracy and extensions, of fractures in midface region using conventional radiography technique.

References

1. A D Reuben, S R Watt-Smith, D Dobson, and S J Golding: A comparative study of evaluation of radiographs, CT and 3D reformatted CT in facial trauma: what is the role of 3D? : *The British Journal of Radiology*, 2005, 78, 198–201.
2. Anuja Agarwala, Nishant Kumarb, Nitin Sharmab: 2D and 3D CT scan a diagnostic adjunct or necessity in maxillofacial trauma: *Indian Journal of Dentistry* 2012; 1-5.
3. R Tanrikulu, And B Erol: Comparison of computed tomography with conventional radiography for midfacial fractures: Dentomaxillofacial Radiology (2001) 30, 141 – 146.
4. Jon Marinaro MD, Cameron S. Crandall MD, David Doezema MD: Computed tomography of the head as a screening examination for facial fractures: American Journal of Emergency Medicine (2007) 25, 616–619.
5. Donald L. Kreipke Jack J. Moss James M. Franco Michael D. Maves David J. Smith3: Computed Tomography and Thin-Section Tomography in Facial Trauma: *American Journal of Neuroradiology* 5:185-189, March/April 1984.
6. Kaleem Ahmad, R. K. Rauniyar, Mukesh Kumar Gupta, Sajid Ansari, Ashok Raj Pant, Abhishek Kumar, Basmah Abdur Rashid: Multidetector computed tomographic evaluation of maxillofacial trauma : *Asian Journal of Medical Sciences* | Oct-Dec 2014 | Vol 5 | Issue 4-39.
7. Usama M. Ibraheem; The value of spiral computed tomography in the diagnosis of facial fractures: Tikrit Medical 76 *Journal* 2008; 14(1):76-81
8. Qais H. Muass, Ibrahim S. Gataa: The diagnostic value of Computed Tomography in evaluation of maxillofacial Trauma: Kufa Med. *Journal* 2009.VOL.12.No1.
9. Denise takehana dos santos, Jefferson xavier oliveira, Michael walter vannier, Marcelo gusmao paraíso cavalcanti.computed tomography imaging strategies and perspectives in orbital fractures. *Journal of applied oral science*: 2007; 15(2):135-9.
10. Jasbir kaur, Rohit chopra: Three dimensional CT reconstruction for the evaluation and surgical planning of mid face fractures: A 100 case study: *j. Maxillo Fac.Oral Surg*. (sept-dec 2010):323-328.

****

How to cite this article:

Mastan Shaik., Vamsi Krishna Reddy and Sasthrulu G.V.N.B.R.2016, "Evaluation of Radiographs, CT and 3d Reformatted ct In Maxillofacial Trauma" – A Comparative Study. *Int J Recent Sci Res.* 7(6), pp. 11817-11821.

TSSN 0976-3031