ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 07 | July - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ROLE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN THE EVALUATION OF MAXILLOFACIAL TRAUMA

Radiology

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ABSTRACT

Multi-detector tomography (MDCT) is extremely helpful in easy detection of maxillofacial fractures and assessment of associated complications. Superimposition of bony structures, a major disadvantage of plain radiographs makes CT scan, the imaging modality of choice for Maxillofacial injuries . Three dimensional and coronal images are being reconstructed using the axial CT images with the help of advancements in computer software. 3D images are helpful in better localization of fractures involving multiple planes and assessment of facial symmetry. With this background, the study was undertaken to evaluate the role of 3D and coronal images in maxillofacial trauma using MDCT.

KEYWORDS

Computed tomography, 3D reconstruction, maxillofacial trauma, mandibular fractures.

INTRODUCTION

Maxillofacial Trauma is a common reason for presenting in the emergency care unit. The frequency & magnitude of traffic accidents and violence have been increasing worldwide. Facial traumas are being considered as a social disease, which cause psychological and cosmetic problems. Proper management of facial trauma needs a comprehensive knowledge of the complex maxillofacial anatomy[1]. Facial bone fractures and soft tissue disruption in this region may lead to facial disfigurement & asymmetry. The detection of fractured facial bones, multiplicity of fragments, degree of displacement and involvement of skull base are clearly assessed by MDCT images[2]. Three dimensional and coronal images are being reconstructed using the axial CT images with the help of advancements in computer software. 3D and coronal images help in better localization of fractures involving multiple planes, assessment of facial symmetry and perception of fracture displacement[3]. With this background, this study was undertaken to evaluate the role of 3D and coronal images in maxillofacial trauma using MDCT.

CASE STUDY

This Descriptive study was done in a study population of 217 patients from January 2022 to June 2022 (six months).Those patients who got admitted in our trauma care unit with the history of maxillofacial trauma and positive for fractures involving maxillofacial bones were selected randomly.

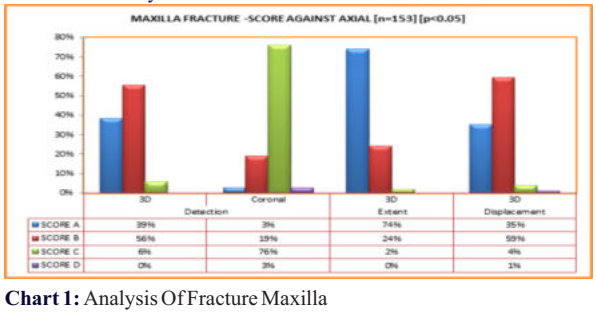


Chart 1: Analysis Of Fracture Maxilla

Table 1: Analysis Of Fracture Maxilla

MAXILLA FRACTURE - SCORE AGAINST AXIAL (n=153)	Fracture Detection (in number of patients)		Fracture Extent (in number of patients)	Fracture Displacement (in number of patients)
	3D	Coronal	3D	3D
SCORE A (Inferior to axial)	59	4	113	54
SCORE B (similar to axial)	85	29	37	91
SCORE C (superior/similar information more rapidly assimilated)	9	116	3	6
SCORE D (superior/additional conceptual information provided)	0	4	0	2

In the analysis of maxilla fractures, 3D images were found to be similar to axial image in fracture detection and displacement in more percentage of the patients, who had fractures in the anterior wall[3]. But the fracture extent to the posterior wall of maxillary sinus was not seen in 3D images in most of the patients, due to overlap of bony anterior wall.

Coronal images have shown superior/similar information more rapidly assimilated compared to axial images in the detection of maxilla fracture in most of the patients.

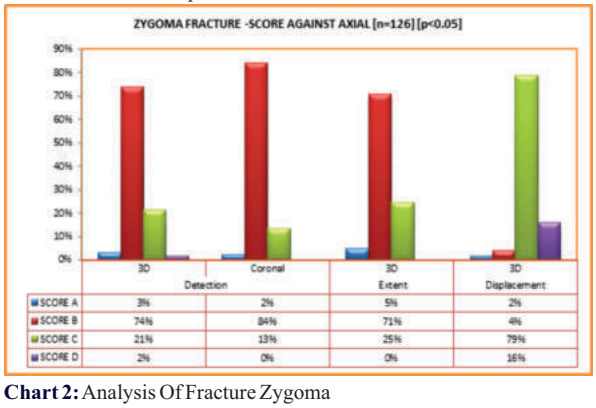


Chart 2: Analysis Of Fracture Zygoma

Table 2: Analysis Of Fracture Zygoma

ZYGOMA FRACTURE - SCORE AGAINST AXIAL (n=126)	Fracture Detection (in number of patients)		Fracture Extent (in number of patients)	Fracture Displacement (in number of patients)
	3D	Coronal	3D	3D
SCORE A (Inferior to axial)	4	3	6	2

SCORE B (similar to axial)	93	106	89	5
SCORE C (superior/similar informationmore rapidly assimilated)	27	17	31	99
SCORE D (superior/additional conceptualinformation provided)	2	0	0	20

In the analysis of zygomatic bone fractures, 3D images were found to be similar to axial image for the fracture detection and extent in most of the patients[4]. In the assessment of fracture displacement, 3D images were superior/similar information more rapidly assimilated compared to axial images in most of the patients.

Coronal images were similar to axial images in the detection of fracture zygoma in most patients.

Table 3: Analysis Of Fracture Frontal Bone

FRONTAL FRACTURE - SCORE AGAINST AXIAL (n=90)	Fracture Detection (in number of patients)		Fracture Extent (in number of patients)	Fracture Displacement (in number of patients)
	3D	Coronal	3D	3D
SCORE A (Inferior to axial)	33	0	74	15
SCORE B (similar to axial)	52	81	13	22
SCORE C (superior/similar informationmore rapidly assimilated)	3	7	2	50
SCORE D (superior/additional conceptualinformation provided)	2	2	1	3

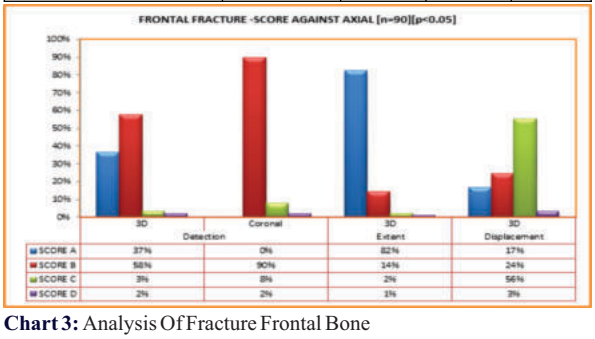


Chart 3: Analysis Of Fracture Frontal Bone

Detection of Frontal fractures were similar on 3D images compared to axial in more percentage of patients. But the fracture extension, especially into posterior wall of frontal sinus was not adequately seen on the 3D images. Displacement of frontal fractures, especially in the anterior wall was superior/similar axial information more rapidly assimilated in 3D images[5].

Coronal images were found to be similar to axial images in the detection of frontal fractures in most of the patients[6]

Table 4: Analysis Of Fracture Mandible

MANDIBLE FRACTURE - SCORE AGAINST AXIAL (n=81)	Fracture Detection (in number of patients)		Fracture Extent (in number of patients)	Fracture Displacement (in number of patients)
	3D	Coronal	3D	3D
SCORE A (Inferior to axial)	3	2	5	3
SCORE B (similar to axial)	61	68	58	2
SCORE C (superior/similar informationmore rapidly assimilated)	17	9	16	13
SCORE D (superior/additional conceptualinformation provided)	0	2	2	63

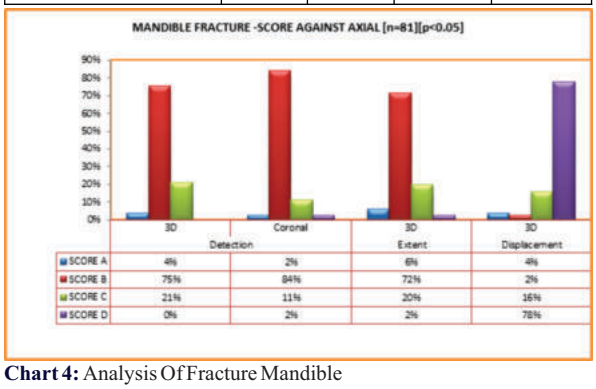


Chart 4: Analysis Of Fracture Mandible

In the assessment of mandible fractures, 3D images were found to be similar to axial images in the fracture detection and extent in most of the patients[7]. For fracture displacement 3D images were superior/additional conceptual information provided in most of the cases.

Coronal images were found to be similar to axial images in the detection of mandible fractures in most of the patients in this study group.

Table 5: Analysis Of Fracture Naso-Orbito-Ethmoid Region

NASO-ORBITO-ETHMOID FRACTURE - SCORE AGAINST AXIAL (n=142)	Fracture Detection (in number of patients)		Fracture Extent (in number of patients)	Fracture Displacement (in number of patients)
	3D	Coronal	3D	3D
SCORE A (Inferior to axial)	103	2	110	98
SCORE B (similar to axial)	36	3	30	36
SCORE C (superior/similar informationmore rapidly assimilated)	3	17	2	7
SCORE D (superior/additional conceptualinformation provided)	0	120	0	1

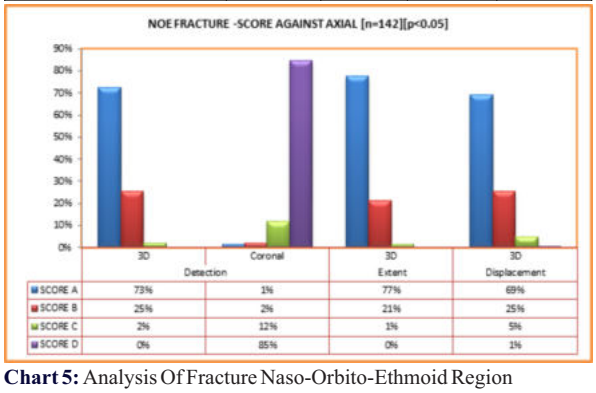
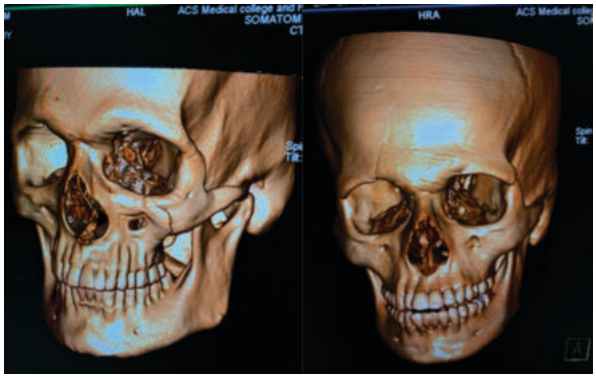
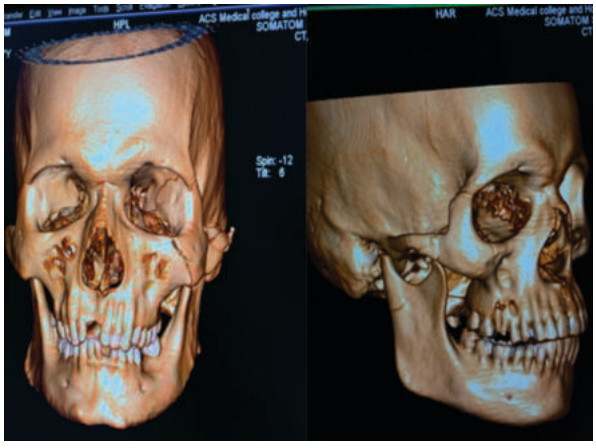


Chart 5: Analysis Of Fracture Naso-Orbito-Ethmoid Region

In the assessment of NOE fractures, 3D images were found inferior to

axial images in fracture detection, extent and fracture displacement in most of the patients[8]. This may be explained by bony overlap in the NOE region and partial volume averaging of thin bones in this region[9]. Compared to axial images in most of the patients, coronal images were superior and additional conceptual information provided in the NOE fractures.





CONCLUSIONS

1. At present, MDCT is the investigation of choice in the evaluation of MaxilloFacial Trauma, as it allows determination of the presence, extent and displacement of facial bone fractures[10].

2. In the setting of Acute trauma, MDCT rapidly provides high resolution Axial, Multi Planar Reformation images and excellent 3D reformation capability with little patient co-operation.

3. Familiarity with the normal facial bone anatomy and the common patterns of Maxillofacial fractures will aid the radiologist to provide an accurate and detailed report on the facial fractures[11].

4. This study demonstrates the precious role of MDCT Coronal and 3D reformation images in the evaluation of Maxillofacial fractures in various aspects, although it gives variable results for different facial bones[12]. It helps for the better evaluation of fractures detected on axial images.

5. In Maxillofacial fractures, the advantages of 3D reconstruction are well demonstrated in the assessment of Zygomatic and Mandibular fractures, especially in fracture displacement. 3D image helps in the easy detection of Frontal and Maxillary fractures involving the anterior wall, but it has limited role in identifying fractures with posterior extension[13]. 3D reconstructions have been shown to be inferior in the assessment of Naso-Orbito-Ethmoid fractures when compared to axial and coronal images.[14] 3D images stand as a valuable tool in the identification of Le Fort fracture lines.

6. Coronal reconstructed images have been proved to be superior in assessingthe Naso-Orbito-Ethmoid and Maxillary fractures. It also plays a useful complementary role with the axial images in the assessment of Frontal, Zygomatic and Mandibular fractures[15].

7. Furthermore, Multi Planar Reformation and 3D images are excellent communication tools for the surgeons, as in the case of complex fractures and very helpful for the preoperative planning[16]

Summary-

A descriptive study was done in A.C.S. Medical college and hospital from January 2022 to June 2022 (six months) to evaluate the role of Multi-detector CT in the evaluation of maxillofacial trauma. 3D volume images are well demonstrated in assessment of zygomatic and maxillary fractures. The most common maxillofacial fracture combination in this study population was fracture Maxilla, Zygoma and Naso orbito ethmoid bones in 25% of patients. Isolated facial bone fracture in this study includes mandible in 10%, NOE in 7%, maxilla in 6%, frontal in 6% and zygoma in 3% of patients.

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