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Simple method of assessment of relation of ocular level and downward displacement of zygomatic complex fracture

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Abstract

Background And Objective: Among the maxillofacial bone fractures mid facial bone fracture and nasal bone fractures accounts more because of its prominent location in the face. Being situated in a projected position in the lateral aspect of the midface, zygomatic fractures occupy the next position in mid facial bone fracture and second in the facial bone fractures. Fractures of zygomatic complex may also involve the eye, but the importance of involvement depends on the degree of displacement of the eye level or globe position. Fracture at the fronto-zygomatic suture level in lateral wall of orbit, affected globe is downwardly displaced along with the fractured zygoma. This downward displacement of level of eye is implicated by the displacement of suspensory ligament which holds the eyeball in position by attaching to Whitnall's tubercle[1].This study is aimed to assess the co relation of downward displacement of level of eyeball in relation to fracture of lateral frontal region of zygomatic rim.

Methods: This descriptive study was conducted for a period of 21 months on 50 patients with unilateral zygomatic complex fracture with lateral canthal level displacement. Globe level difference occurring in zygoma fracture was assessed by measuring level of difference in affected side with normal side lateral canthal eye displacement occurring during fronto-zygomatic dysjunction in zygomatic complex fracture. Assessment is carried out clinically by using marked spectacle, radiographically using PNS X RAY, Coronal view of CBCT and intraoperatively frontozygomatic dysjunction measured during surgical exposure.

Results: The results of this study showed that incidence of ZMC fractures are more in males. It was found that there is a gradual increase of 0.665 mm separation in bony fragments in lateral frontal region to 1mm level

difference in pupillary level. Statistical analysis were found to be significant as p value of 0.0001 was obtained in assessment of ocular displacement and fronto-zygomatic dysjunction

Conclusion: The study has shown a male predominance for zygomatic complex fractures within an age group of 20-40 years of age. For every 1mm in the pupillary level displacement in zygomatic complex fracture there is a 0.665mm displacement in the bony architecture at lateral frontal region. From the study it is learned that the bony displacement at the lateral frontal region has got a definitive effect on the displacement of the pupillary level in the zygomatic complex fracture.

Keywords: Zygomatico Maxillary Complex Fracture, Frontozygomatic Dysjunction, Ocular Displacement, PNS X Ray, CBCT, Whitnall's Tubercle

Introduction

Among the maxillofacial bone fractures, mid facial bone and nasal bone fractures accounts more because of its prominent location in the face. The zygoma occupies the antero-lateral position giving prominence to cheek in the mid face region. Being situated in a projected position in the lateral aspect of the midface, zygomatic fractures occupy the next position in mid facial bone fracture and second in the facial bone fractures[2,3,4] In several studies it has been shown that young adult males were commonly affected. The sex distribution is markedly higher for males than for females 4:1(Rana et.al 2012)[5]. The zygoma plays an important role in the formation of facial contour in the lateral region of face for both cosmetic and functional reason. Therefore zygomatic bone injuries should be properly diagnosed and adequately treated. Zygomaticomaxillary complex fractures often present with pain, tenderness, ecchymosis and edema over the malar prominence, lateral orbit, upper and lower eyelids with loss of malar projection, and blunting of the lateral canthus may be evident compared to the unaffected side. Medially displaced zygomatic arch fractures may impinge on the coronoid process or temporalis tendon, resulting in trismus. Paresthesia in the region of the infraorbital nerve is a common neurosensory problem. Involvement of the orbital floor along with zygomatic bone fracture may result in extraocular muscle dysfunction/ entrapment, diplopia or enophthalmos.

The zygomatic bone usually fractures in the region of zygomatico frontal suture, zygomatico-temporal suture and the zygomatico-maxilllary suture. Fractures of zygomatic complex can affect orbit and eyeball. Involvement of globe depends on the degree of displacement of the eye level or globe position in downward direction. During separation at fronto-zygomatic suture in lateral wall of orbit fracture, affected globe is displaced downward along with the fractured zygoma. This downward displacement of level of lateral canthus of eye is implicated by the displacement of suspensory ligament which holds the eyeball in position by attaching to downward Whitnall's tubercle[4] .It may be noted that downward displacement of eye depends on the location of fracture line in lateral orbital wall with reference to orbital tubercle, only the fracture line superior to the orbital tubercle can bring about an inferior displacement in ocular levels and the fracture lines inferior to the Whitnall's tubercle may not bring above changes but it accompanies some amount of enophthalmos and lower eyelid may be pulled downward because of attachment of lid fascia - orbital septum-orbital rim. (Mustrade J.C, 1968)[6]

This study is aimed to assess the co relation of downward displacement of level of eye ball in relation to fracture of lateral frontal region of zygomatic rim. Relation of downward displacement in pupillary level

and displacement of lateral frontal suture following zygomatic complex fractures was assessed clinically, radiographically, and surgically.

1. Clinical assessment of lateral ocular displacement made by making the patient seated erect, relaxed and asked to look straight at the observer, spectacles with graded measurements sticked on to the eye piece is placed in such a way that lateral canthi of uninvolved eye and medial canthi of involved eye lies in 0mm, downward displacement of affected eye's lateral canthus is marked and measured.
2. Using photographs to measure the relation between the change in ocular level and the downward displacement of the zygomatic complex
3. Using paranasal sinus view (PNS) and CBCT, to measure the relation between the change in ocular level and the downward displacement of zygomatic complex.
4. To assess the significance of change in ocular level and downward displacement of fractured fragments by direct visualization after surgical exposure of lateral frontal region

The evaluation included –

1. History taking
2. Clinical examination
3. Clinical measurement of ocular displacement using graded scale
4. Radiographic measurement `
5. Photographic measurement
6. Measurement during surgical exposure

Clinical Measurement of Displacement In The Palpebral Fissure

A spectacle with powerless lenses having graduated scale on the eye piece was used to measure displacement of lateral canthus. Clinical assessment of ocular displacement was made by the making the patient seated erect relaxed and asked to look straight at the observer, spectacles with graded measurements sticked on to the eye piece is placed in such a way that lateral canthi of uninvolved eye and medial canthi of involved eye lies in 0mm, downward displacement of affected eye's lateral canthus is marked and measured.

Fig. 1: Graduated spectacle for measuring ocular displacement

Photographic Measurement

A standardized photograph of face in frontal view was taken. A line drawn along the medial and lateral canthus of unaffected eye extending to the affected side and its deviation from the present interpupillary line is assessed by a graded centimetre scale. The angulation at the coincidence of lines are also assessed.

Fig. 2: Eye level displacement measured using standardized photograph

Radiographical Evaluation

A) PNS view

Digital PNS view of the patient was taken and traced on to an acetate tracing paper. Mc-Gregor and Campbell's first and second lines were drawn on the unaffected side. The orbital walls were traced. The displacement of the zygomatic bone in the lateral frontal region is measured.

sn- supraorbital notch

if- infra orbital foramen

fz- frontozygomatic dysjunction

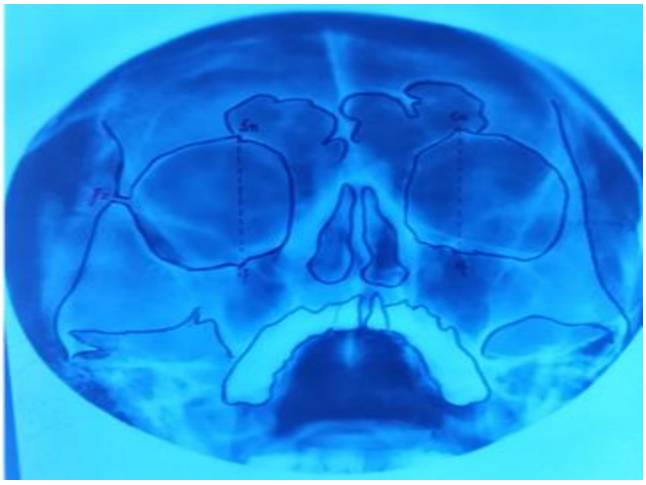

Fig. 3: PNS X ray with tracings to measure the frontozygomatic dysjunction

Line passing through the supra orbital notch in the supra orbital rim to the infra orbital foramen in infraorbital rim is drawn vertical measurement were taken from the both rim in each eye The measurements of both orbital rim were compared to know displacement of lateral frontal region

B) CBCT

The CBCT image was obtained using Planmeca Promax 3-D MID machine with software Romexis, version 4.1.1.R available at the institution A cone beam computed tomography (CBCT) of orbit is taken in coronal view and the displacement is assessed by the measuring scale present in the CBCT Planmeca software.

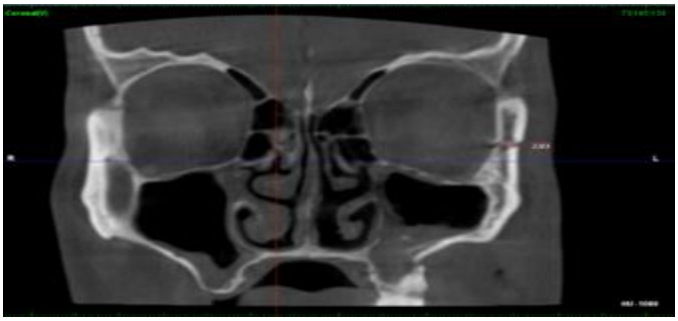

Fig. 4: Coronal view of CBCT for measuring frontozygomatic dysjunction

During Surgical Exposure

Once the patient planned to undergo open reduction and fixation, is intubated under general anaesthesia lateral wall of orbit exposed to locate the fracture. The separation observed at the fracture segments measured using a sterile Vernier caliper.

Fig. 5: Vernier calipers

Fig. 6: Fronto zygomatic dysjunction measured using Vernier Caliper

Discussion

This study was carried out to determine the relationship of downward displacement of eye ball and dysjunction of lateral frontal region in fronto zygomatic complex fracture The location of fracture line in the lateral wall of orbit with respect to the location of Whitnall's tubercle determines the ocular displacement. Fractures line that runs superior to the Whitnall's tubercle results in

downward displacement of eye level, whereas those fracture line running inferior to the Whitnall's tubercle leaves the eye level unaffected. The Whitnall's tubercle is located at the lateral orbital wall 11mm inferior to the fronto-zygomatic suture approximately 1 mm posterior to the lateral orbital rim, and provides attachment to suspensory ligament of Lockwood which in turn supports the eyeball laterally[6]. Clinical ocular levels were assessed by using a spectacles with powerless lenses having graduated measurements on the eye piece it was used to measure the displacement of lateral canthus compared to unaffected side. The graduated scale was present on both glasses on nasal and temple regions. Clinical assessment of ocular displacement was made by the making the patient seated erect and relaxed position and was asked to look straight at the observer, spectacles with graduated measurements was placed in such a way that lateral and medial canthi of uninvolved eye and medial canthi of involved eye lies in 0mm , downward displacement of affected eye's lateral canthus was marked and measured. Out of the fifty patients 3 had no displacement. 1mm displacement is seen 4 patients, 2mm in 18 patients, 3mm in 18patients, 4mm in 5 patients, 5mm in 1 patient and 6mm in 1 patient.In photographic assessment out of the 50 patients no displacement was foundin 5 patients, 1mm displacement found in 7 patients, 2mm displacement found in 25patients, 3mm displacement found in 11 displacement patients and 4mmdisplacement found in 2 patients.Radiological assessment of displacement in lateral frontal region was done by using paranasal sinus view(PNS) and Coronal view o

In PNS evaluation the Dolan's lines were taken and traced on to an acetatetracing paper. Mc-Gregor and Campbell's first and second lines were drawn on theunaffected side. The orbital walls were traced. The displacement of the zygomatic bone in the lateral frontal region is measured with line passing through the supra orbital notch in the supra orbital rim to the infra orbital foramen in infraorbital rim drawn vertical measurement were taken from the both rim in each eye. The measurements of both orbital rim were compared to know displacement of lateralfrontal region The PNS evaluation for lateral frontal displacement, 1mmdisplacement was found in 4 patients, 2mm displacement was found in 5 patients,3mm displacement found in 4 patients, 4mm displacement found in 8 patients, 5mmdisplacement was found in 15 patients, 6mmm displacement found in 7 patients,7mm displacement was found in 3 patients, 8mm displacement found in 1 patientand 10mm displacement found in 1 patient.

The CBCT image was obtained using Planmeca Promax 3-D MID machine with software Romexis, version 4.1.1.R available at the institution A cone beam computed tomography (CBCT) of orbit was taken in coronal view and the displacement is assessed by the measuring scale present in the CBCT Planmeca software. CBCT evaluation of lateral frontal displacement varies from 0 to 4.21mmwith a mean value of 2.239.The significance of Whitnall's tubercle and Lockwood's ligament in holding the globe in its anatomical position was initially described by S.E. Whitnall in 1911in his cadaveric observations published as "On a tubercle on the malar bone, and onthe lateral attachments of the tarsal plates" where in the mentioning of Whitnall'sies should be properly diagnosed and treated in order to maintain unique face morphology[1]

Conclusion

Descriptive study carried out for evaluation of 50 patients with unilateral zygomatico maxillary complex fractures with vertical dystopia yielded the following.

The incidence of zygomatic complex fracture is more common between 2 nd and 4 th decade of life with male predominance, and is similar to other studies[7,8,9]. Clinical correlation of the level of pupillary displacement has got a significance with displacement of the fractured lateral frontal region in the zygomatic complex fracture. It was evaluated that for every 1mm displacement of lateral canthal level displacement,there is a 0.665mm displacement in the bony architecture. This interpret that the bony displacement at the lateral frontal region has got a definitive effect on the displacement of the papillary level in the zygomatic complex fracture. Clinician and surgeon should be aware of the fact that the proper reduction in all three dimensions viz., vertical, horizontal and antero posterior is needed in acquiring the original projection of the zygomatic complex to achieve symmetry of face.

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