Figure legends

Figure 1

Intraoperative view showing that the periosteal incision is being extended superolaterally by inserting one blade of scissors under the periosteum and cutting the ridge line toward the frontozygomatic suture.

Figure 2

Schematic diagram of the dissection plane of an extended transconjunctival approach. The posterior limb of the lateral canthal ligament is either transected or stripped off (red dashed arrow).

Figure 3

A wide operative field obtained by an extended transconjunctival approach. The frontozygomatic suture and the sphenozygomatic suture are widely exposed in one unobstructed operative field. **Ragnell retractor lateral to the lateral orbital rim is retracting the periosteum dissected from the lateral orbital rim and the anterior limb of the lateral canthal ligament is not disrupted, only to be retracted over the periosteum.**

Figure 4

Approach to the orbit. The approach to the orbit evolved from a subciliary approach to a transconjunctival approach and then to an extended transconjunctival approach. The transition occurred in 1995 and in 2009.

Figure 5

Approach to the frontozygomatic suture for ZMC fractures. The approach to the frontozygomatic suture evolved from a lateral brow incision, a lateral canthotomy, and to a lateral upper blepharoplasty incision, and then to an extended transconjunctival approach.

Figure **6**

A 12-year-old girl with a posteriorly displaced left ZMC fracture. Three-point fixation through an extended transconjunctival approach and a gingivobuccal sulcus incision without skin incisions.

(above) preoperative CT. (below) postoperative CT.

See also Supplementary Video Content.

Figure 7

A 17-year-old boy with a left ZMC fracture.

(above) Preoperative CT: The left ZMC was posteriorly displaced (blue arrows) with comminution of the lateral buttress and inferior orbital rim. There was only an incomplete greenstick fracture at the left lateral orbital wall, which resisted every attempt at reduction, and the left zygomatic arch was overly bowed (blue arrowheads) with a fracture at the base of the zygomatic process of the temporal bone.

(below) Postoperative 3D CT: Note the gap at the sphenozygomatic suture was maintained with sphenozygomatic fixation (yellow circle) with proper facial projection re-established without fixation of the zygomatic arch, which otherwise would have been required. Fixation of the comminuted lateral buttress was spared (red circle), which would have required extensive subperiosteal dissection and could have resulted in segmentalization of the lateral buttress.

Figure 8

The same case as in Figure 7.

Every attempt to reduce the posteriorly displaced left zygoma failed and **osteotomies** of the left frontozygomatic suture and sphenozygomatic suture **were** required. After the sphenozygomatic osteotomy through an extended transconjunctival approach, the displaced zygoma was pulled forward (yellow arrow) and was fixated at the sphenozygomatic suture with a square-shaped micro three-dimensional titanium plate. Wide exposure offered by the extended transconjunctival approach enabled accurate reduction and fixation.

Figure 9

A 53-year-old male with a single-segment type I left NOE fracture.

(above) Preoperative CT: The fractured medial maxillary segment was displaced posteriorly (yellow arrowheads) with separation of the frontomaxillary suture (yellow arrow).

(below) Postoperative CT: Three-point fixation of the NOE fracture was carried out through an extended transcaruncular approach combined with a transconjunctival approach. The medial buttress was plated through a gingivobuccal sulcus incision. No skin incisions were made.

Figure 10

The same case as in Figure 9.

Intraoperative photograph of the plate fixation for the NOE fracture. The dissection plane was posterior to the posterior lacrimal crest and superior to the medial canthal ligament. The operative field was just sufficient for three-hole plate fixation.

Figure 11

The same case as in Figure 9.

6-month postoperative photograph. No eyelid deformity, nor cutaneous scar were present with good restoration of the naso-orbital valley.

Figure 12

Schematic drawing of an extended transconjunctival approach and extended transcaruncular approach.

A periosteal incision will be extended superolaterally beyond the frontozygomatic suture (yellow arrow: extended transconjunctival approach) and superomedially beyond the frontomaxillary suture (green arrow: extended transcaruncular approach). The area shaded by pink color is a very wide operative field obtained by combined extended transconjunctival and extended transcaruncular approach.

Figure 13

Eight consecutive patients after open reduction and internal fixation of the ZMC fracture utilizing an extended transconjunctival approach without skin incisions. Posterior limb of the lateral canthal ligament was stripped off without canthal reattachment in all cases. No patient showed lateral canthal malposition postoperatively. Stars indicate the operated side.

(left from top to bottom) a 12-year-old girl with a left ZMC fracture, 6-month postoperative photograph, the same patient as in Figure 6 and in the Supplemental Video Content, a 17-year-old male with a left ZMC fracture, 1-year postoperative photograph, a 24-year-old male with a left ZMC fracture, 6-month postoperative photograph, an 18-year-old male with a left ZC fracture, 7-month postoperative photograph

(right from top to bottom) a 17-year-old female with a left ZMC fracture, 6-month postoperative photograph, a 59-year-old male with a right ZMC fracture, 9-month postoperative photograph, a 25-year-old male with a right ZMC fracture, 6-month postoperative photograph, a 28-year-old male with a right ZMC fracture, 7-month postoperative photograph