*Basrah Journal*

*Of Surgery*

*Bas J Surg, September, 14, 2008*

# MEDIAL CANTHAL TENDON REPAIR IN TELECANTHUS PATIENTS

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## Abstract

This study aimed to provide a comprehensive review of the techniques used for reconstruction of the medial canthal tendon in telecanthus cases and to analyze the most suitable reconstructive methods for different medial canthal tendon lesions methods. This clinical study has been done on 22 patients with a 25 medial canthal tendons (MCT) lesions and attended to Al-wasiti and surgical specialties hospitals in the period from February 2003 and march 2004. The cases studied from clinical, aesthetic and reconstructive aspects.

All patients presented with telecanthus and either congenitally lax or injured medial canthal tendons. Reconstruction of the lesions was done using four different surgical techniques dirct repair of the medial canthal tendon (canthorraphy) done for four patients, medial canthal tendon (anterior limb) plication for six cases, transnasal canthopexy was done for nine patients with open reduction and fixation of frontal process of maxilla were done for six patients. We conclude that desired surgical outcome can be achieved where there is bony attachments of the medial canthal tendon.

## Surgical Anatomy

The Medial part of the orbital region is a complex structure of several facial bones, attachments for support of the eye and lacrimal collecting system[1].

The medial wall of the orbit is composed of mostly thin bones ranging from 0.2-0.4 mm in thickness, the length of the wall is approximately 5 cm, the ethmoid bone makes up most of the medial wall with contributions from the lacrimal bone[2].

The Lacrimal bone and the frontal process of the maxilla contain the fossa for the lacrimal sac. The upper portion of the fossa is in contact with the anterior ethmoidal cells while the lower portion shares a common wall with the middle meatus. The anterior part of the fossa although formed by maxillary bone is called the Anterior Lacrimal Crest, while the posterior part is called Posterior Lacrimal Crest, a small opening inferiorly caries the naso-lacrimal duct through the lateral wall of the nose to the inferior meatus. The lids are firmly anchored in place by the connective tissue of the MCT medially and LCL laterally. Both of which attach to the bony margin of the orbit, behind the plane of cornea[3] (Fig.1).

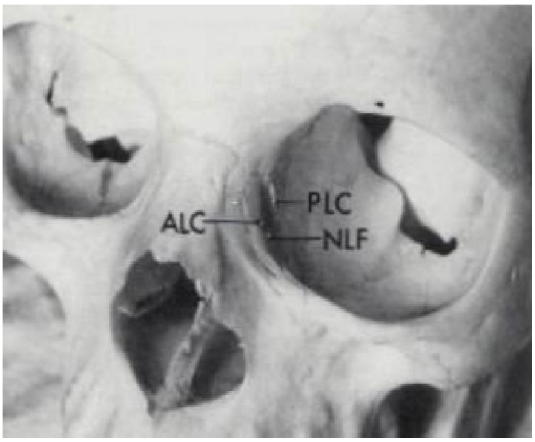


**Fig.1: Anatomy of Lacrimal Fossa, PLC= posterior lacrimal crest, ALC= Anterior lacrimal crest, NLF= nasolacremal foramena**

**Medial canthal tendon (MCT)**

It is somewhat triangular in shape attached to the maxilla from the anterior lacrimal crest nearly to its suture with the nasal bone, it has lower border below which pass some fibers of orbicularis, above, it is continuous with the periosteum. Its base is at the anterior lacrimal crest where it divides[4]. The posterior part is continuous with the lacrimal fascia covering the upper part of the lacrimal sac. The anterior part divides at the medial canthus into two bands crossing the lacrimal fascia, (but not in contact with the sac) to blend with medial ends of the tarsal plates. These bands form a Y shape on its side with the main tendon. The two branches correspond to the lacrimal parts of the lid margins and contain the lacrimal canaliculi enclosing caruncle and bounding the medial canthus. The anterior surface of the tendon is adherent to the skin and faces anterolateral, while its branches faces anteromedial together making an obtuse angle (Fig.2).

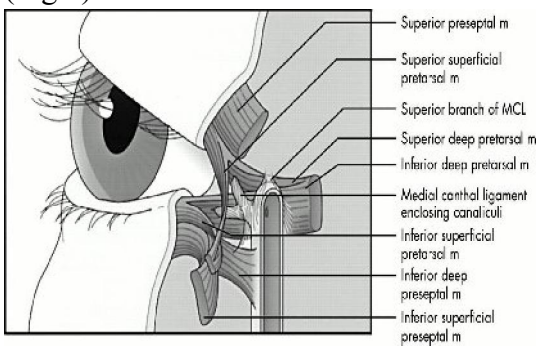


**Fig.2: Anatomy of MCT.**

A deep or reflected part of the tendon is arise as it crosses the lacrimal sac to attach behind it. Jones suggests that this structure should be recognized as a tendon rather than a ligament because it is considered as a connector for muscle[1].

## Functions

The MCT provide globe support as a part of suspensory sling, which is in continuity with the lateral canthal ligament, and upper and lower tarsal plate.

Tear suction: The MCT and the orbicularis oculi musculature perform as a lacrimal pump, creating positive and negative pressure on opening and closing of the eyes and they ensure flow of the tears from the puncta through the system. The MCT is also important in maintaining the configurations of the palpebral opening. Since the MCT anchors the tarsal plates to the medial wall of the orbit, so it helps in the attachments of the orbicularis-oculi musculature.

**Pathology**

Rupture of the medial canthal tendon (cut across): Occur as a result of sharp foreign body or by sharp bone fragment[5]. surgery in the region as in tumor excision[6]. Avulsion of the medial canthal tendon: usually results from sever blunt trauma[7]. Fracture displacement of bone structure: The medial canthal tendon usually is not severed from bone. Such injuries are usually result of traffic accident, assault[6] (Fig.3,4&5).

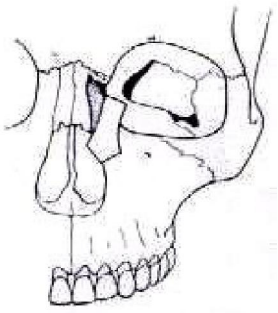

**Fig.3: Displacement of the frontal process of the Maxilla.**

**Fig.4:Patient with severe left side post-traumatic Telecanthus.**

**Fig.5: a. Inferior deviation of right medial canthus, b. roundening of the right medial canthus.**

In congenital anomalies like blepharophimosis where there is an elongation of the medial canthal tendon usually associated with ptosis of upper eyelids and epicanthal folds, the tissue of the medial canthal region anchored upon the globe, covering the caruncle and portion of the sclera[8]. The bridge of the nose appears flattened and widened, which make the eyes appear far apart, often the intercanthal distance is increased (telecanthus). The width of the palpebral fisher is reduced leading to phimosis.
In severe cases of blepharophimosis there may be minor degrees of orbital hypertelrism There is almost always an absence of the supratarsal folds in the upper eyelids. There is nearly always an excess of skin and also of subcutaneous tissue between the skin and the underlying skeletal structure[8] (Fig.6).

**Fig.6: Congenital blepharophimosis**

In order to quantitate the associated bony and soft tissue canthal deformities. Various authors have reported on methods of measurements and normal distances, using palpitation and X-ray techniques (Fig.7).

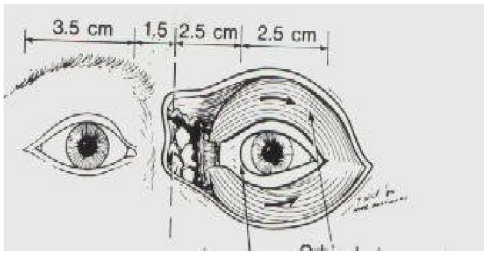


**Fig.7: Widening of the left ICD (Telecanthus).**

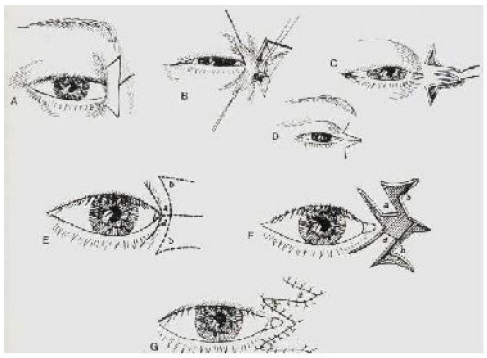

**Fig.8:Double opposing Z-Plasty(Converse approach) A,B,C,D, Four rectangular-flaps (Mustardae) E,F,G.**

The intra-orbital distance (IOD or Distance between the bony medial walls of the orbit) Distances vary with age, sex and there are intra-racial differences is usually less than 25 mm in the female and 28 mm in adult male.
The inter-canthal distance (ICD) or distance between the medial canthi, can vary from 22 mm in infant to 32 mm in the adult and the telecanthus means increase in this distance more than half of the interpupillary distance.
The interpupillary distance (IPD) between the center of the two pupils (in normal gaze) can vary from 60 to 70 mm. in adult.
The outer canthal distance (OCD) is the distance between the lateral canthi.
Approximation of normal can be obtained by recognizing that intercanthal distance should be equal to the papebral fissure length (PFL) and the canthus should be midway between the midsagital plane of the nose and the center of the pupil[1], by comparing these parameters

canthal measurements of Chinese and those data published overseas, the results show PFL and OCD where significantly larger in Hong kong Chinese, whereas ICD was smaller[9].

## Material and Methods

Twenty-two patients with widening of the intercanthal distance were selected, and underwent surgical repair of medial canthal tendon by one of four procedures over a period of 13 months (from February 2003 to March 2004).

Four patients underwent direct anterior limb repair (canthorraphy) for completely divided medial canthal tendon, bilateral injuries were excluded. Three patients with 6 tendons underwent anterior limb Plication for congenital laxity of medial canthal tendons with blepharophimosis, patients with sever bony deformity were excluded. Nine patients underwent transnasal canthopexy for avulsed medial canthal tendons. Six patients underwent open reduction and fixation by miniplate and screws for displaced bone fragment that bare the insertion of the medial canthal tendon, patients with combined avulsed tendon and bony deformity were excluded.

A detailed history was taken including the causative agent, emergency management, complaint, duration, previous operations, associated illnesses and complications. In congenital cases there is concentration on the gynecological, family history and other congenital disorders.

Clinical examination: Inspection; to detect the visible traumatic deformities, aesthetic and functional abnormalities which include the shape and the movement of the eyelids. epiphora. Epicanthal fold may develop. Deep palpation of the upper mid face to identify the bone landmarks and to detect the bony abnormalities (overlapped margins, steps, spiky ridges and callus over production. Bowstringing test. Attachment of the MCT can be determined by palpation of a subcutaneous bowstring as one stretches the lid laterally. Comparison with the other side or with other normal person with the aid of radiological findings of bony displacement and callus overproduction.

These findings were confirmed by surgical exposure, and a decision was made to choose the appropriate bone correction procedure. By measurements and comparison of known anatomical distances of various parts of the orbital area Measurements of canthal parameters: Outer Canthal Distance (OCD), Inner Canthal Distance (ICD), Palpebral Fissure Length (PFL), Naso-Canthal distance (NCD), Canthal Index (CI): is calculated by ICD/OCD x 100

Visual impairment and movements of the eye were studied by ophthalmological consultation. CT scan examination in both axial and coronal planes defines the extent of the fractures unilaterally and bilaterally and documents any associated fractures. MRI: it is very beneficial especially in defining the image of the soft tissue states so it is the procedure of choice in evaluating of the lesion[10].

Patients were photographed (frontal and close up views).

**Operative measures**

Pre-op marking utilizing canthal parameters. type of the incision depend on the case requirement. In order to carry out different surgical procedures in the same operation, it is necessary to achieve a wide exposure of the lesion. Therefore utilize one way of the following roots:

The original facial scars[7], Fronto-ethmoidal approaches (Lynch incisions)[7], A frontal scalp flap (bi-coronal, bi-temporal) [Whitaker & Schaefer][7], Z- plasty incision, Open sky (Converse & Hogan) Fig(8 a, b, c, d), Mustardae approach[7] Fig(8 e, f, g).

Whatever type of incision is used it will be followed by Careful and detailed exposure of all bony lesion and elimination

of any overlap of the margins. A precise excision of all scar tissue. Identification of the medial canthal tendon[11]. The surgical procedures on medial canthal tendon:- varies as follows:

a. Anterior limb repair (medial canthorraphy) was applied to patients with mild to moderate traumatic telecanthus where the canthal index was less than 38, and confirmed by surgical findings of minimal tissue loss from the medial canthal ligament and its anatomical integrity can be addressed easily used in a neatly severed tendon where there is no tissue loss and the tendon available for primarily suturing.

The suture used was 4\0 vicryl (Polygalactinic acid) to restore the continuity of the remnant on the medial canthus with the stump on the periosteal side. Four simple interrupted stitches were sufficient , in some cases, a mattress core stitch was used, reinforced with two simple interrupted sutures.

b. Anterior limb plication:- used to treat the congenital laxity of the tendon with blepharophimosis. Through Mustardae incision, identification of the lax tendon firstly done, then completely separated from the fibrous tissue around it, a key suture was inserted 2mm from the medial canthus and secured by 3 knots over this prolene 4\0 suture then a distant suturing applied according to pre-op measurements (6-8) mm to plicate and folding the tendon another 2 mattress suture applied to secure the plication, advancement of the medial canthus as a flap one according to pre-op measurements (8-10mm) , then transposition of other 4 skin flap proceed by using of 5\0 prolene for skin closure in simple interrupted manner.

c. Transnasal canthopexy:- is used in patients with avulsed tendon. The medial canthal tendon and the surrounding tissue are fixed on 4/0 stainless steel wire, and this wire passes through the holes on the lateral nasal walls and septum driven by hand pice and bear, the MCT is secured by stainless steel wire is to be knotted over a toggle or a button over the contra lateral side, according to surgeons preference toggle used in 4 patients while button used in 5 patients

d. Reduction and fixation of the bone fragments:

According to the operative finding, combination of procedures were performed to achieve bone re alignment, osteotomies to detach the bone fragment from its abnormal position and remove excessive bone formation , bone graft was needed in two cases. After restoring of the anatomical continuity or tightening of the medial canthal tendon, the wound closed in 2 layers using 5\0 chromic cat gut in subcutaneous tissue and 5\0 prolene put at simple interrupted sutures for skin closure.

**Postoperative measures**

1. Dressing usually done with steri stripe, occlusive eye dressing was put for few hours.
2. The patient was put in semi sitting position.
3. 50-100 mg /kg/day cephalosporin was administered for 3 days post operatively in divided doses intravenously and orally for another two days and continued for longer period as indicated , all patients received chloramphenicol eye drops for seven days.
4. All patients were fit to be discharged on 2nd post operative day.
5. Skin stitches were removed after 5-7 days in the outpatient clinic.
6. The patients were followed up for 6 month post operatively twice weekly in the first two weeks, once a week for the next month , and once monthly for six month for evaluation of functional , aesthetic and numerical (biometric) assessment.

**Assessment methods**

The assessment was carried out by the same member of the team for functional,

aesthetic, and numerical, while the assessment of the symmetry was done by another team member.

1. Functional assessment:- because of many patients in the study had functional deterioration of the collecting system function, post operative absence of the epiphora that was present pre operatively was chosen as a representative of functional recovery.
2. Aesthetic assessments:- depending on.

a. correction of rounded or downward tilted medial canthus.
b. abolition of epicanthal fold.

3. Symmetry, due to complexity of the midfacial area we relied upon a third eye for independent evaluation of symmetry.
4. Numerical assessment:- for assessment of the result numerical method described by Kruskal who used (ICD/OCD X 100) to obtain the canthal index, when canthal index was 38 and above it is considered as a severe telecanthus.

## Results

The total number of patients included in the study was 25. The epidemiological data were as follow:

Sex distribution**:** Male 16 (64%), female 9 (36%). Distribution of the cases according to the side of the tendon: Left 16 (64%) right 9 (36%). Age distribution:- The age of the patients included in the study varies between 4 years and 60 years Below 6 y 6 (24%) 7-45y 17 (68%) Above 45 year 2 (18%). Data were explained in the tables

## Discussion

The surgical treatment of telecanthus remain one of the most challenging areas in facial reconstruction.

This is a clinical study, the results of which may not be statistically significant, as the number of cases studied is small and cannot reflect the actual percentage among population.

Regarding the age of the patients , the high percentage of the patients were between (7-45) years (68%), while in Micheal Bryan's study there was predominantly affliction of young's (20-40) years.

High mid-face trauma are most often seen in young adult males ,children have a low incidence due to the relative larger cranial size, high ratio between cranial and mid-face sizes and the lack of the complete maxillary sinus pneumatization[13].

Number one cause for this deformity is the Road Traffic Accident (44%) which agree with Mathogs's and Micheal Bryan's studies , with the presence of other cause but in different sequence, and the appearance of war injuries cases in our series, this may be because of deferences in life style.

The patients presented an average 7.5 years following their original operations while in Geoffrey's study, the average presentation time was 3.2 years, this could be referred to the patient's level of education.

Although some advocate immediate repair in stable patients with post traumatic telecanthus, no significant deleterious

**Table I:Causative agents**

| Case | No. of cases | % of total |
|---|---|---|
| **RTA** | **11** | **44%** |
| **Congenital** | **6** | **24%** |
| **War injury** | **4** | **16%** |
| **Iatrogenic** | **2** | **8%** |
| **Assault** | **1** | **4%** |
| **Animal bite** | **1** | **4%** |

**Table II: Patients distribution according to Duration.**

| **Duration** | ***No. of cases*** | **% of total cases** |
|---|---|---|
| **< 1m** | **2** | **8%** |
| **>1m,<1y** | **8** | **32%** |
| **>1y,<10y** | **9** | **36%** |
| **>10y** | **6** | **24%** |

**Table III: No. of previous operations distribution.**

| No .of previous operation | % of all cases |
|---|---|
| No previous operation done (for the repair) | 40% |
| Only the emergency operation done | 28% |
| Less than four operation done for repair | 20% |
| Four and above operation done for the repair | 12% |

**Table IV: Patients divided into four groups according to the type of surgical procedure**

| group | Surgical procedure | No. of cases | % |
|---|---|---|---|
| I | Canthorraphy | 4 | 16% |
| II | Plication | 6 | 24% |
| III | Transnasal canthopexy | 9 | 36% |
| IV | Bone fragment reduction & fixation | 6 | 24% |

**Table V:Average operative time table**

| **Group** | **Average time** |
|---|---|
| **I** | **40 min** |
| **II** | **45 min** |
| **III** | **95 min** |
| **IV** | **80 min** |
| **Average** | **65 min** |

**Table VI: Functional assessment using the epiphora pre&post op as indicator.**

| group | No of cases with epiphora Pre op. | (%) of cases with epiphora Pre op. | No of cases with epiphora Post op | % of cases with epiphora post op. |
|---|---|---|---|---|
| I | 2 | 50% | Zero | Zero |
| II | Zero | Zero | Zero | Zero |
| III | 6 | 66% | 1 | 11% |
| IV | 4 | 66% | Zero | Zero |
| TOTAL | 12 | 48% | 1 | 4% |

**Table VII: Assessment by identification of the symmetry pre&post op. using a 3rd eye**

| group | No. of the Asymmetrical cases pre-op | % of the Asymmetrical cases pre-op | No. of the Asymmetrical cases post-op | % of the Asymmetrical cases post-op |
|---|---|---|---|---|
| I | 4 | 100% | 1 | 25% |
| II | Zero | Zero | zero | Zero |
| III | 8 | 88% | 1 | 11% |
| IV | 6 | 100% | 1 | 16.5% |
| Total | 18 | 72% | 3 | 12% |

**Table VIII: Aesthetic assessment by a comparison between 3 abnormal morphological signs that appear due to rupture of MCT which are, appearance of the epicanthal fold, rounding &inf. deviation of the medial canthus.**

| group | Epicanthus | | Angle rounding | | Angle deviation (inf.) | |
|---|---|---|---|---|---|---|
| | Pre op | Post op | Pre op | Post op | Pre op | Post |
| I | 50% | zero | 100% | zero | 100% | zero |
| II | 100% | zero | zero | zero | zero | zero |
| III | 88% | zero | 55% | zero | 66% | zero |
| IV | 83% | zero | 100% | zero | 100% | zero |
| TOTAL | 84% | zero | 60% | zero | 64% | zero |

**Table IX: Transcutanous approaches.**

| group | 5 flap tech. | | One z plasty | | Original scar | | lynch | |
|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % |
| I | 2 | 50 | 1 | 25 | 1 | 25 | --- | - |
| II | 6 | 100 | --- | --- | --- | --- | --- | - |
| III | 3 | 33.3 | 3 | 33.3 | 3 | 33.3 | --- | -- |
| IV | 1 | 16.5 | --- | --- | 4 | 66.6 | 1 | 16.5 |
| Total | 12 | 48 | 4 | 16 | 8 | 32 | 1 | 4 |

**Table X: Canthal Index measurements table pre- post operatively.**

| Group | CI (mean) pre operatively | Mean CI post operatively |
|---|---|---|
| I | 36.27 | 31.08 |
| II | 41.7 | 31.83 |
| III | 40.2 | 31.72 |
| IV | 39.73 | 31.05 |
| Total | 39.75 | 31.48 |

**Table XI: ICD changes table pre &post operatively.**

| Group | Changes |
|---|---|
| I | 6.5 mm |
| II | 9 mm |
| III | 7.8 mm |
| IV | 9 mm |
| Average | 7.96 mm |

**Table XII: Post operative complications table.**

| group | No. of case | %of cases | Type of complication |
|---|---|---|---|
| I | 1 | 25% | Ant. displacement of the med. Canthus with over reduction |
| II | zero | zero | --- |
| III | 2 | 22% | wire stripping |
| IV | zero | zero | |
| Total | 3 | 12% | |

effect appears to have resulted from a delay of 7-14 days.

In our study two patients were repaired without delay and ended with desirable surgical outcome and with less complication.

In congenital cases, there is general agreement for surgical management by usage of anterior plication through Mustarde's approach, and this procedure was applied in six congenital telecanthus with blepharophimosis cases.

Surgical management of cases with post traumatic telecanthus was optional therapy where most of plastic surgeon insist on soft tissue reconstruction while maxillofacial surgeon deal with a lot of concentration on bone surgeries (osteotomies, bone resection, refinement and bone graft).

In mild to moderate telecanthus (6mm and below) canthorraphy (direct Medial Canthal Tendon repair) was desired.

This idea was agree with Perri-Retling's study.

**Assessment of the surgical repair**

All the 22 patients were assessed by clinical, aesthetic, symmetry and numerical methods.

In group I (canthorraphy); 2 patient was complaining of epiphora preoperatively, it had disappeared postoperatively, due to meticulous anatomical restoration of the medial canthus and patent lacrimal system , this showed that epiphora is not a reliable sign of trauma to naso lacrimal apparatus and that why Medial Canthal Tendon repair was carried before Dacrocyctorhinostomy.

Only one patient out of four in this group didn't get symmetry and this related to the anterior displacement with over reduction of medial canthus.

According to Kruskal study, all the four patient had mild to moderate telecanthus with mean canthal index 36.27, the post operative mean canthal index became 31.08 which is quite normal and they got mean advancement of the medial canthus of 6.5 mm.

In group II; all the 6 cases with blepharophimosis telecanthus that were treated with anterior limb plication and Mustardaeplasty, although they presented with sever telecanthus and mean canthal index of 41.7, but they have desired surgical outcome without any complication, those patients had very mild bony abnormalities, bilateral lesions, virgin areas with less fibrous tissue, lax tendons liable for plication and the use of four flaps approach in all cases.

In group III; all the 9 patients had avulsed Medial Canthal Tendon, sever telecanthus with mean CI of 40.2 the telecanthus was corrected post operatively and the mean CI become 31.72 with 7.8 mm advancement of medial canthus, epiphora was not corrected in one patients and this might be due to iatrogenic insult of lacrimal apparatus or due to improper surgical treatment, two patients in this group remain asymmetrical and that might be due to transnasal wiring performed anterior to the medial canthus, because of difficulties in identifying the bone landmarks, or fault penetration level of the wire through the nasal septum.

In group IV; the six patients had severe telecanthus with mean Canthal Index of 39.73, the telecanthus was successfully repaired and the post operative mean Canthal Index became 31.05 with 9 mm advancement of medial canthus, epiphora was corrected in four patients, they had it preoperatively, only one patient out of the 6 stayed asymmetrical due to old long vertical scar contracture crossing from forehead to the medial canthus.

Most patients in this series had the clinical signs of ruptured Medial Canthal Tendons with appearance of epicanthal fold, rounding and inferior deviation of the medial canthus; all these signs were easily corrected.

In all patients we faced two major difficulties during surgery; first one was awling through the nasal bones where there was 2-3 failed trials, this problem can be avoided by the use of mini or micro plate rigid fixation. The other problem was profuse bleeding during surgery and it was avoided in late cases by cauterization of angular vessels, in counteraction to the idea of Andrie M. Varvinski who stated that the angular vessels are avoidable.

The access to this area in most patients was through Mustardae approach or one z plasty to overcome tension on the site of Medial Canthal Tendon repair and to override scar contraction.

When the scars are hypertrophic and unsightly, the choice of approach was through it.

Wire stripping was recorded with two patients in group III that might be due either to inadequate stabilization over the toggle that used or to the type (hard) of stainless wire that used in those two patients, where there was difficulty in securing knot over the toggle. Because of this stripping some advocated to use button instead of toggle as in this study button used in five patients out of nine in group III the buttons caused intense skin irritation with unrelieved sensation and all patients asked us many times to stop preceding of the management rather than keeping that button. Secondary operations were done for those two patients successfully.

No post operative Infection was recorded due to the usage of local and systemic antibiotic agents.

## Recommendations

1. Late reconstruction is a difficult task that requires repositioning of both bone and soft tissue by high coordinated surgical teams of both maxillofacial and plastic surgeons at proper timing.
2. Scar contraction is the major cause of poor surgical outcome in late correction of post traumatic telecanthus.
3. Asymmetry is the most common residual deformity in post surgical period and the underlying cause of this discrepancy is the presence of long scar contracture in the periocular area. This deformity can be abolished by interdigitation of normal skin in the scar pathway.
4. Better results were achieved when the Medial Canthal Tendon attachment remain intact while bad result are seen when the tendon was avulsed (no bony attachments).
5. Elective cauterization of angular vessels facilitate surgery.
6. Cutaneous repositioning flaps are necessary when no mobilization of periocular tissue to allow an unstressed repair of Medial Canthal Tendon.
7. Functional obstruction in the lacrimal collecting system is not uncommon.
8. Warning the patients that they may have residual deformity after their original injures so it is very important to be regularly followed up by their surgeons.

9. Open reduction and fixation of medial orbital rim decreases the need of transnasal canthopexy.

10. Other studies are needed to confirm or dispute this hypothesis.

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