ORIGINAL ARTICLE

SELECTIVE EARLY SUTURE REMOVAL IMPROVES VISUAL ACUITY AND REDUCES ASTIGMATISM IN TRAUMATIC CORNEAL REPAIRS

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HOW TO CITE THIS ARTICLE:
Swapna Kaipu, Ravikumar Reddy K, Srinivas Prasad Kilani, Chandra Sekhar G, Rama Mohan Pathapati, Madhavulu Buchineni. "Selective Early Suture Removal Improves Visual Acuity and Reduces Astigmatism in Traumatic Corneal Repairs". Journal of Evidence based Medicine and Healthcare; Volume 1, Issue 16, December 22, 2014; Page: 2017-2022.

ABSTRACT: BACKGROUND: Traumatic corneal injuries are the leading causes of blindness in young adults and frequently occur during occupational activities. Corneal astigmatism after post traumatic corneal wound repair is the most common complication which can halt good visual outcome. We studied whether early suture removal minimizes suture related astigmatism in post-traumatic corneal wounds. **METHODS:** This interventional study was conducted during 2007-2009. All traumatic corneal injury patients attending emergency room were operated within 12 hours from time of injury by a single surgeon. Interrupted suture technique followed with 10-0 mono filament nylon was used for corneal wound repair. Patients were followed every 2weeks for a period for 3-5 months. Suture removal was done after 8-10 weeks following surgery based on changes in corneal curvature as assessed by keratometric reading selectively. **RESULTS:** Out of 28 patients, who underwent corneal wound repair, only 25 patients (25 eyes) came for regular follow-up. There mean age of the patients was 25±1.5 yrs. We observed an apparent increase in astigmatism with increase in length of laceration. ($p=0.06$). After suture removal Best corrected visual acuity increased by an average of 0.24±0.04 ($p<0.0001$) from 0.17±0.03 to 0.41±0.02 and an average decrease of 2.03±0.54 D of keratometric astigmatism from 3.78±0.81D to 1.75±0.62 D. ($p<0.0001$). One patient had wound gaping as complications of early suture removal. 6 patients developed delayed traumatic cataract as a complications of trauma. None of the patients had vascularized scar. **CONCLUSION:** Steep meridian estimation allows selective early suture removal after corneal wound repairs. Selective suture removal at the end of the 7th week will reduce astigmatism significantly and gives earliest visual rehabilitation.

KEYWORDS: Astigmatism, Early suture removal, Corneal laceration injury, Best corrected visual acuity, Keratometry.

INTRODUCTION: Trauma is the leading cause of blindness in young adults and is commonly seen during occupational activities.[1] Corneal astigmatism after post traumatic corneal wound repair is most common complication that can prevent a good visual outcome in an eye with otherwise healthy visual system.[1] Many procedures have been adopted to reduce astigmatism in post-traumatic corneal wound repair. Many factors such as length of laceration, location, angulations, type of suture material, the number of suture bites, length of bites and suture tension determines visual outcome.

Routinely suture removal is usually done at 16-18 weeks after corneal wound repair. The results of earlier studies on the influence of early suture removal on astigmatism in post-

traumatic corneal wound repair are speculative.[2] The theoretical advantage of early selective suture removal is that surgeon can control astigmatism. A cornea with laceration can show quite substantial alteration of refraction during the first ten postoperative weeks. There after it becomes more stable and after a year little alteration is seen. Since cornea is subjected to variation during the early weeks of healing, there is an opportunity of adjusting an astigmatic refraction. Selective early suture removal is one of the practices adopted postoperatively. The advantage of selective removal of interrupted sutures which was initially started in eyes undergoing penetrating keratoplasty is to reduce astigmatism.[3] We applied the same concept to evaluate the influence of early suture removal on astigmatism and visual acuity following post traumatic corneal wound repair.

METHODS: This interventional study was conducted at Sarojini Devi Eye Hospital, Hyderabad from August 2007 to August 2009. Institutional ethics committee approved the study protocol. Written informed consent was obtained from study participants. Both male and female patients above 10yrs of age and with clean cut laceration wounds of cornea were studied. Patients with posterior segment involvement, lacerations extending to sclera, Iris incarceration and infectious wound were excluded. Each patient followed a protocol of examination which includes measurement of uncorrected and best corrected visual acuity and keratometry.

All cases were operated within 12 hours from time of injury by a single surgeon. Interrupted suture technique with 10-0 mono filament nylon was used for corneal wound repair. All the patients were followed every 2weeks for a period of 16-18 weeks. The sutures were removed selectively based on changes in corneal curvature as assessed by keratometric reading. Pre suture and post suture keratometric readings were compared for changes in astigmatism regardless in changes of axis. Standard Snellen's visual acuity chart was used for measurement of both uncorrected and best corrected visual acuity. Visual acuity was considered improved if it is better by one or more line and subjective feelings.

STATISTICAL ANALYSIS: The data was entered in Microsoft excel spread sheet. Statistical analysis was performed using Graphpad Prism version-4 USA. Continuous data was presented as mean and standard deviation and categorical data as actual numbers. Paired t test was applied as a test of significance for keratometric and visual acuity readings before and after suture removal. A two tailed p value less than 0.05 was considered statistically significant.

RESULTS: A total of 28 patients were treated for clean cut corneal lacerated among them 25 eyes of 25 patients were followed regularly and 3 were lost for follow up. There mean age of the patients was 25±1.5 yrs. There are 17 (68%) male and 8 (32%) female patients. Gender differences were not significant. 22 (88%) of the patients were between the age group of 21-30 yrs. 21 (84%) of the patients had more than 1/3rd of corneal diameter lacerations. (Table-1) A paired comparison of pre removal and post removal keratometry reading indicate that best corrected visual acuity increased by an average of 0.24±0.04 ($p<0.0001$) from 0.17±0.03 to 0.41±0.02 and an average decrease of 2.03±0.54 D of keratometric astigmatism from 3.78±0.81D to 1.75±0.62 D. ($p<0.0001$).(Graph-1&2) None of the patients had visual

deterioration after suture removal. One patient had wound gaping as complications of early suture removal. 6 patients developed delayed traumatic cataract as a complications of trauma. Vascularized scar was not observed in any of the patients. The number of patients who had changes in BCVA (best corrected visual acuity) and astigmatism can be seen from table-2&3.

DISCUSSION: Ocular trauma is a leading cause of visual loss in young adults. Corneal astigmatism after post traumatic corneal wound repair is most common complication that can prevent good visual outcome in an eye with otherwise healthy visual system.[1] It arises from many causes like length of laceration, location and angulation.

M.J. Roper-hall[2] described the possibility of adjusting astigmatism during the early postoperative period by selective removal of one or more interrupted sutures or adjustment of a continuous suture.

Eagling EM.[4] reported that the principle factor contributing to astigmatism was wound size. Patients with laceration involving less than 1/3rd of corneal diameter had a low incidence of astigmatism and many achieved good vision unaided, while those with laceration exceeding 1/3rd of corneal diameter had significant astigmatism requiring correction to achieve good vision. In our study the length of laceration is less than 1/3rd of corneal diameter in only 4 patients and in the remaining patients it is more than 1/3rd of corneal diameter. No patient had more than 4D of astigmatism in this group. More than 4D of astigmatism present in 43% (n=9) of patients with corneal laceration more than 1/3rd of corneal diameter. Severity of astigmatism depends upon the length of laceration. Before suture removal 18 patients had astigmatism more than 2.25D and only one patient had less than 0.5D astigmatism.

M.J. Roper-Hall[2] stated that if the damage extends to involve the central cornea, there will be gross irregular astigmatism. In our study 9 patients, who have astigmatism of more than 4D shown length of laceration is >3mm and laceration is more nearer to the centre of cornea.

In our study we found that, after suture removal, astigmatism decreased to less than 0.5D in 7 patients. P.S.Binder[5] reported the mean astigmatism with selective interrupted suture removal and continues suture in place was 3.0D in post keratoplasty cases. Burk[6] and co-workers reported that 74% of 50 eyes had less than 3D of residual astigmatism after selective suture removal.

In our study the mean decrease in astigmatism after early suture removal was statistically significant. One of the possible explanations could be that early suture removal would minimize suture induced astigmatism by decreasing compression. However some amount of residual astigmatism is present due to severity of injury, scarring and alteration of corneal topography.

Our results on visual outcome are quite similar to those of the previous studies performed by Moncrieff and Scheribe P,[7] Charles C. Barr,[8] and Edmund[8] related the initial visual acuity to final visual outcome. Charles C. Barr[8] reported final visual outcome of better than 6/12 in 62% of patients with zone one injuries. In our study Best corrected visual acuity of 6/12 present in 32% of patients before suture removal compared to 52% of patients after suture removal. 68 % (n=17) patients had Best corrected visual acuity of less than or equal to 6/60 is present before suture removal and only 3 patient had 6/6 or 6/9 vision before suture removal. After suture removal 7 (28%) patient's vision improved to 6/6. Only 3 (12%) patients had visual acuity of less

than 6/60 due to central location of injury and development of dense scarring following wound repair. No visual deterioration after early suture removal. One patient developed wound gaping at the time of early suture removal due to delayed healing. Immediately re suturing was done. The delayed healing may be due to use of steroids and elderly age of the patient.

In our study 6 patients developed cataract during follow up, though their lens at the time of admission was appeared normal. Eagling EM[4] reported high incidence of vascularised scar formation due to anterior synechae and iris incarceration in his study. He concluded wounds crossing the limbus had a higher incidence of anterior synechae compared with central wounds. There is no incidence of vascularised scar formation in our series. This is due to meticulous care taken during the suturing to prevent iris incarceration and we used hyaluronic acid (healon) to reform the anterior chamber in all the cases.

One striking feature noted in the series is no incidence of infection. The low incidence of infection may be due to meticulous debridement, post-operative care and selection of only zone one corneal injuries. Additional procedures were done in 7 patients, re suturing in one patient and lens matter aspiration and IOL implantation in 6 patients.

CONCLUSION: We observed that severity of astigmatism is in parallel with the length of corneal laceration. Lacerations involving the central cornea are associated with gross irregular astigmatism. Steep meridian estimation allows selective early suture removal after corneal wound repairs. Selective suture removal at the end of the 7th week will reduce astigmatism significantly and gives earliest visual rehabilitation.

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Astigmatism In Diopter	< 1/3rd of corneal diameter (n=4)	>1/3rd of corneal diameter (n=21)
0-0.5	2	3
0.75-2.00	1	4
2.25-4.00	1	6
>4.00	0	8

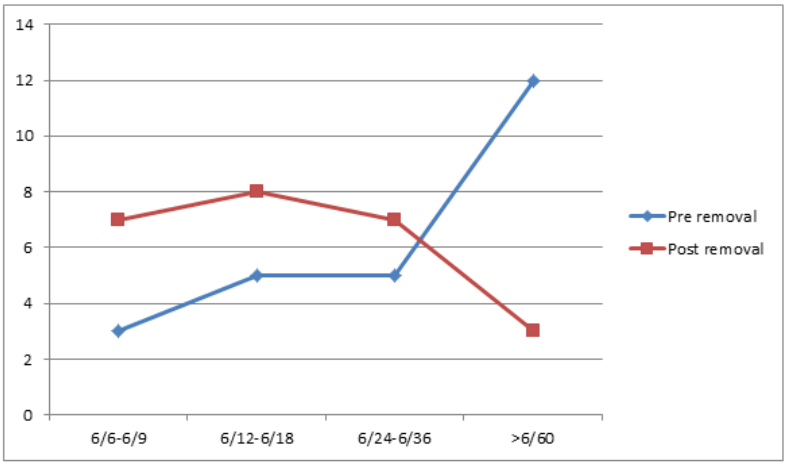
Table 1: Length of laceration of corneal diameter

BCVA	Pre removal	Post removal
6/6 - 6/9	3	7
6/12 - 6/18	5	8
6/24 - 6/36	5	7
<6/60	12	3

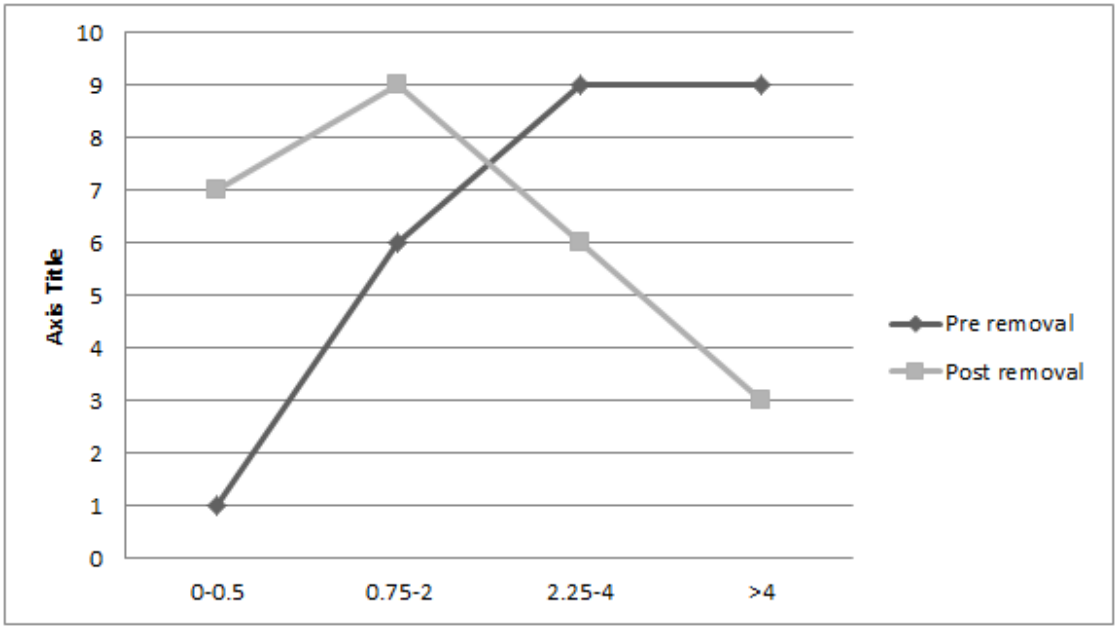
Table 2: Best corrected visual acuity

In Dioptre	Pre suture removal	Post suture removal
0-0.5	1	7
0.75-2	6	9
2.25- 4	9	6
>4	9	3

Table 3: Astigmatism



Graph 1: Changes in Best corrected visual acuity before and after suture removal



Graph 2: Changes in Astigmatism before and after suture removal

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Date of Submission: 07/12/2014.
Date of Peer Review: 08/12/2014.
Date of Acceptance: 11/12/2014.
Date of Publishing: 18/12/2014.