RESULTS

STATISTICAL METHODS

An IBM compatible PC was used to store and analyse the data and to produce graphic presentation of some important results. SPSS statistical package was used for the statistical analysis. Details of formulae used are given in standard statistical books (Armitage P, 1971)

Descriptive Statistics:
Data are summarized using
- the Arithmetic Mean as an average describing the central tendency of observations,
- the Standard Deviation as a measure of dispersion of results around the mean,
- the Number of Observations for each variable studied.

Comparison of Means:
This comparison is done using
- the student's t-test for comparison of means of 2 independent groups (patients and controls).
- the paired t-test for comparison of means of the same variable in the same group.
- Analysis of Variance (ANOVA Test) for comparison of means of more than 2 groups together. This may be followed by t-test for comparison of groups 2X2.

Correlation study:
Correlation between variables is done using Regression Analysis (r-test). This test detects if change in 1 variable is accompanied by a corresponding change in the other variable. A significant correlation may be positive indicating that the change in the 2 variables is in the same direction or negative indicating that the change in the 2 variables is in the opposite direction.

Comparison of percentages:
Qualitative variables expressed as percentages are compared in different groups using the Chi-square test. The test compares the frequencies in different groups to theoretical values under the null hypothesis. The same test is used for comparison of 2 or more groups. The Fischer's exact formula is used with small frequencies to avoid false significance.

Level of significance:
For all the statistical tests done, the threshold of significance is fixed at the 5% level (p-value). A p-value >0.05 indicates non significant result. A p-value $<= 0.05$ indicates a significant result and the p-value is the degree of significance. The smaller the p-value obtained, the more significant is the result; the p-value being the probability of error of the conclusion, i.e. the probability of seeing a given difference by chance. When the role of chance falls below 5%, it may be neglected and the difference may be considered a true significant difference.

RESULTS

In this study 40 eyes of 37 patients were included for cataract extraction. Fifteen of them had a posterior chamber intraocular implants, 5 silicon and 10 j-loop lens.

The average change in distribution of Keratometric astigmatism before surgery and after by one week, one, two and three months is shown in(Fig.15). It shows high incidence of astigmatism one week after the operation in the two groups of patients, the scleral and mid limbal group. The midlimbal group is greater in the amount of astigmatism than the scleral group. Then both groups start to decrease to reach a minimum degree in 3 months after the operation, still the midlimbal group is higher.

(Fig.16) shows the mean change in Keratometric astigmatism during the study period. Before surgery it is 0.587 D in scleral group and 0.499 D in midlimbal one. One week after the operation, it is 3.795 D in scleral and 7.827 D in midlimbal group. Keratometric astigmatism starts to decrease gradually to reach 2.897 D in scleral group and 6.5 D in midlimbal group one

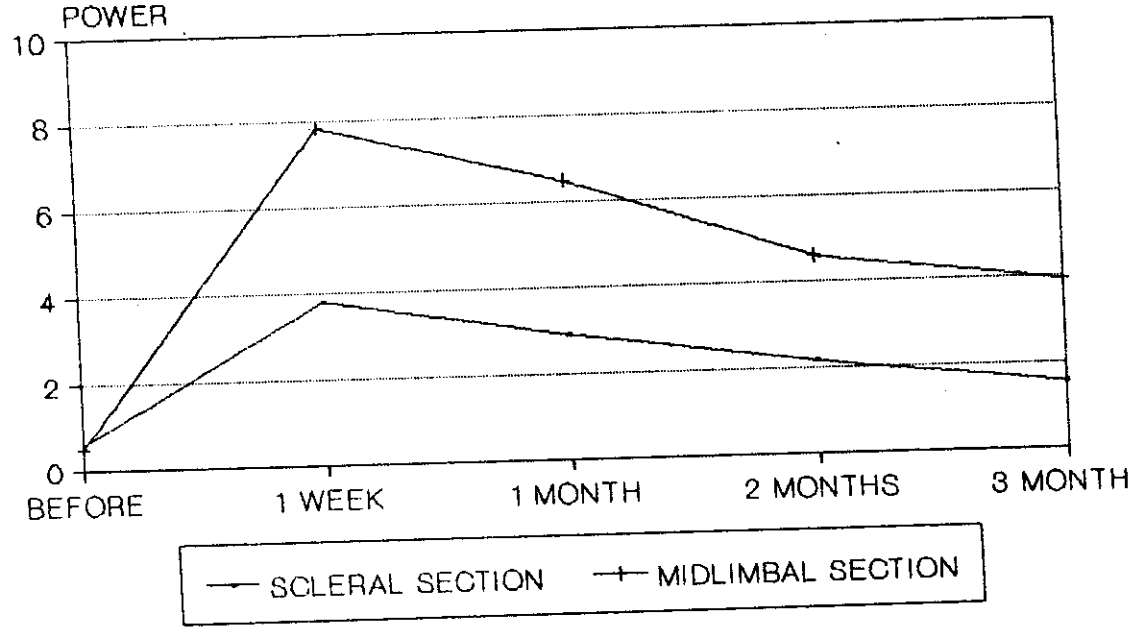
month after the operation. At the second month, it becomes 2.166 D in the first group and 4.592 D in the second one.In the last month it decreases to reach 1.55D in scleral group and 3.94 D in midlimbal group.(Table 1)

Statistical comparison shows a non significant difference between the 2 groups before operation ($p = 0.35$) After surgery, the differences are proved to be statistically significant with p values <0.01 after 1 week, and after 1 month, <0.001 at 2 and 3 months after operation.

As regard the change in Keratometric astigmatism in each group along the study period, (table 2)it is evident that the changes in the scleral group are statistically significant.

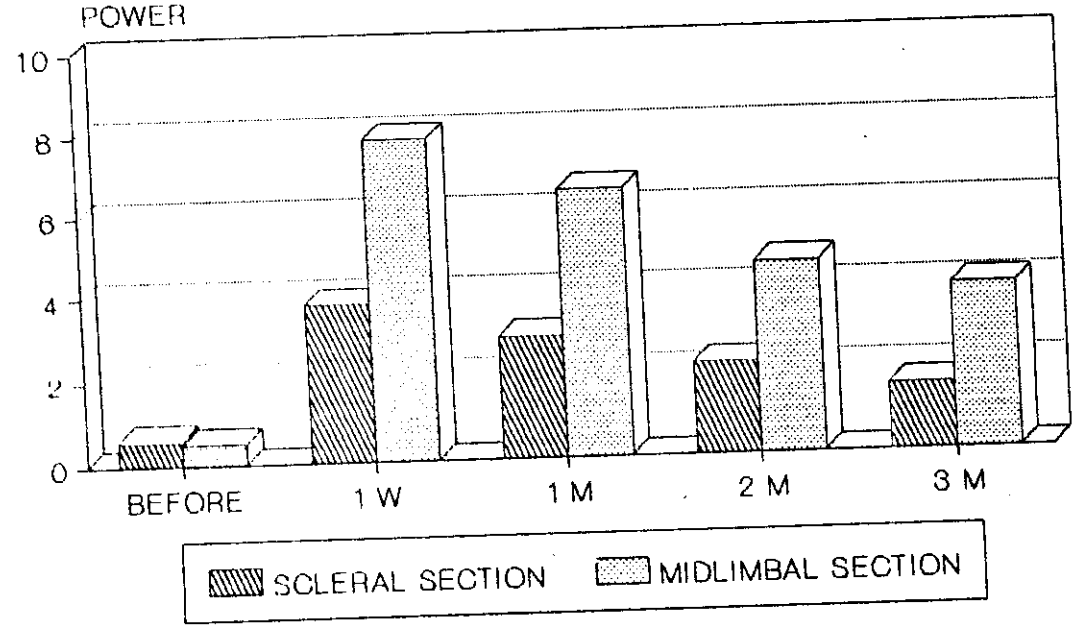
In the scleral group the mean change in K astigmatism between before and one week after surgery is 3.349 D and is statistically significant ($p < 0.0001$). The difference in K astigmatism between one week and one month is 1.221 D ($p < 0.05$); and between one and two months is 0.927 D ($p < 0.05$); and lastly between 2 and 3 months is 0.418 D ($p < 0.01$); all are statistically significant. The mean difference between before operation and 3 months after operation is 1.032 D ($p < 0.01$).

Fig.(15): CHANGE IN MEAN DIOPTERIC POWER OF THE CORNEA AS DETECTED BY KERATOMETER IN THE 2 GROUPS DURING THE STUDY PERIOD



N = 20 IN EACH GROUP

Fig.(16): MEAN DIOPTERIC POWER OF THE CORNEA AS DETECTED BY KERATOMETER DURING THE STUDY PERIOD



N = 20 IN EACH GROUP

TABLE(1):THE MEAN CHANGE IN KERATOMETRIC ASTIGMATISM OF BOTH GROUPS DURING THE STUDY PERIOD WITH RESULTS OF STATISTICAL COMPARISON BETWEEN THE TWO GROUPS.

	BEFORE	AF.1W	1 MONTH	2 MONTHs	3 MONTHS
Scleral group	0.587	3.795	2.897	2.166	1.553
Mid limbal group	0.499	7.827	6.476	4.592	3.942
P.Value	0.3	0.0007	0.0007	0.001	0.0001
T.Value	0.379	4.250	3.44	3.211	4.129

TABLE (2):THE MEAN CHANGE IN KERATOMETRIC ASTIGMATISM IN EACH GROUP DURING THE STUDY PERIOD.

	SCLERAL GROUP			MID LIMBAL GROUP		
	MEAN CHANGE K.ASTIGMATISM	P.VALUE	T.VALUE	MEAN CHANGE K.ASTIGMATISM	P.VALUE	T.VALUE
BE/1WEEK AF OPERATION	3.349	0.00006	4.992	7.328	0.00003	9.9014
1WEEK/1MON	1.221	0.0425	1.843	1.350	0.0421	1.8222
1MON/2MON	0.927	0.0279	2.073	2.22	0.0044	3.0049
2MON/3MON	0.418	0.0146	2.427	0.720	0.0015	3.5743
BE.OPERT/ 3MONTH.AF	1.032	0.0089	2.6224	3.417	0.00002	7.6536

BE = Before AF = After

In the midlimbal group , the mean change in K astigmatism between before and one week after the operation is 7.328 D ($p < 0.0001$), and between 1 week and 1 month after surgery is 1.350 ($p < 0.05$). The mean change between 1 and 2 months is 2.22 D ($p < 0.01$), and between 2 and 3 months is 0.720 D ($p < 0.01$). The mean change between before the operation and 3 months after it is 3.417 D ($p < 0.0001$); all are statistically significant.

Manifest astigmatism is the refractive type of astigmatism. It is calculated for all patients in this study in the first, second and third months to detect the pattern of its change and the difference between Keratometric and manifest astigmatism.(Fig. 17)

In the first group of patients, the mean manifest astigmatism is 1.6 D at the first month, 0.9 D at the second month and 0.7 D at the third month. It decreases along the study period. In the midlimbal group, it is 1.8 D at the first month, 1.6 D at the second month and 1.3 D at the third month.(table 3)

Comparing the 2 groups as regard manifest astigmatism, it is noticed that the only significant difference is in the third month reading ($p < 0.05$).

Fig.(17): THE MEAN CHANGE IN MANIFEST ASTIGMATISM DURING THE STUDY PERIOD

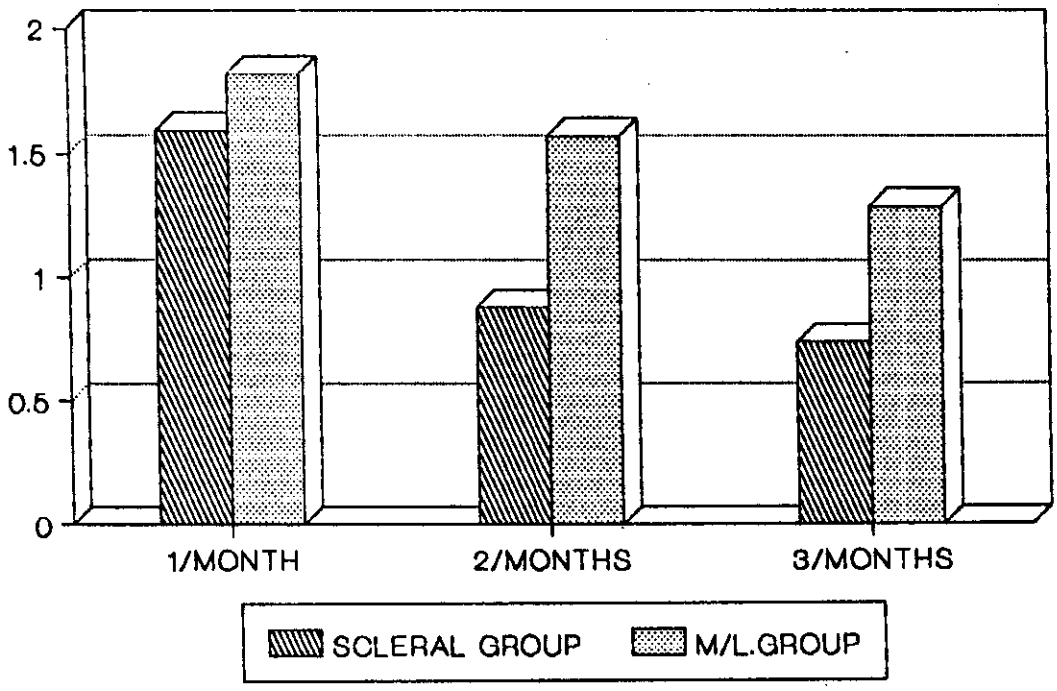


TABLE (3):THE MEAN CHANGE IN MANIFEST ASTIGMATISM DURING THE STUDY PERIOD WITH RESULTS OF STATISTICAL COMPARISON BETWEEN THE TWO GROUPS.

	ONE MONTH	TWO MONTHS	3 MONTHS
SCLERAL GROUP	1.593	0.883	0.736
MID LIMBAL GROUP	1.823	1.566	1.289
P. VALUE	0.373	0.0557	0.030
T. VALUE	0.4799	1.6438	1.9439

Comparison of manifest astigmatism in each group during the study period shows that the changes in the scleral group between one and three months is nearly similar to that of the midlimbal group.(table 4)

(Table 5) shows the distribution of types of astigmatism during the study period. (Fig.18-22).

In the scleral group, 55% of cases have no astigmatism preoperatively which disappears immediately after the operation then appears again at the end of the first month to reach 16% of cases, and becomes 18% and 17% at 2 nd and 3 rd months after the operation.

With the rule astigmatism forms only 10% of cases preoperatively. One week after operation it predominates to form 82% of cases then gradually declines to become 58% one month after the operation, 41% two months after operation and 39% at the last month.

Against the rule astigmatism constitutes 30% of cases preoperatively, then disappears one week after the operation. One month after the operation it is detected in 26% of cases, then in 35% of the second month and in 39% in the third month.

TABLE (4):THE MEAN CHANGE IN MANIFEST ASTIGMATISM IN EACH GROUP DURING THE STUDY PERIOD.

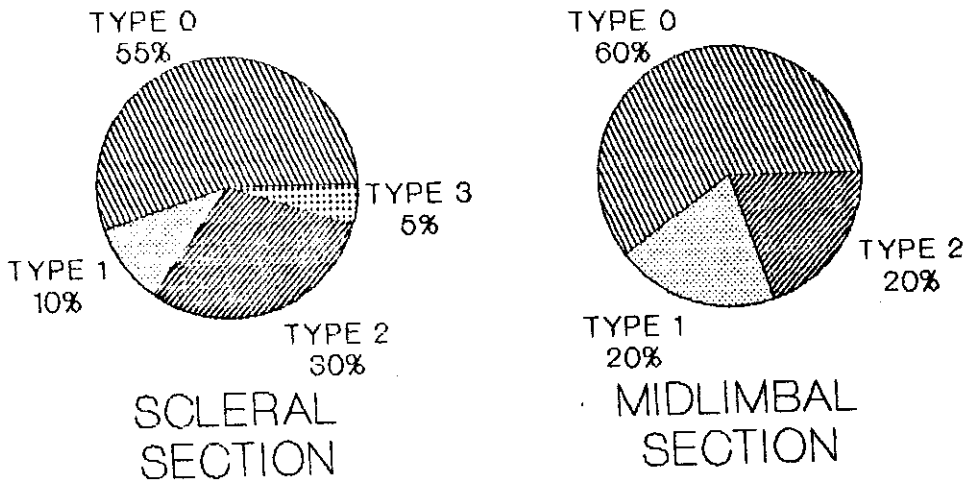
	SCLERAL GROUP			MID LIMBAL GROUP		
	MEAN CHANGE M.ASTIGMATISM	P.VALUE	T.VALUE	MEAN CHANGE M.ASTIGMATISM	P.VALUE	T.VALUE
ONE MONTH/ TWO MONTH	0.625	0.269	2.1589	0.538	0.0235	2.2136
TWO MONTH/ THREE MONTH	0.0893	0.333	0.4413	0.3571	0.0429	1.8594
ONE MONTH/ THREE MONTH	0.75	0.0105	2.6234	0.531	0.0148	2.4026

M = Manifest

TABLE (5):DISTRIBUTION OF TYPES OF ASTIGMATISM DURING THE STUDY PERIOD.

	TYPE OF ASTIGMATISM	BEFORE OPERAT.	ONE WEEK AF	ONE MON. AFTER	TWO MON. AFTER	3 MON. AFTER
SCLERAL GROUP	Spherical Cornea	55%	0	16%	18%	17%
	With the rule	10%	82%	58%	41%	39%
	Against the rule	30%	0	26%	35%	39%
	Oblique	5%	18%	0	6%	6%
MID LIMBAL GROUP	Spherical Cornea	60%	0	0	0	0
	With the rule	20%	80%	60%	63%	79%
	Against the rule	20%	0	20%	19%	21%
	Oblique	0	20%	20%	19%	0

Fig.(18): TYPESOF ASTIGMATISM IN THE 2 GROUPS BEFORE OPERATION



N - 20 IN EACH GROUP

Fig.19: TYPES OF ASTIGMATISM IN THE 2 GROUPS 1 WEEK AFTER OPERATION

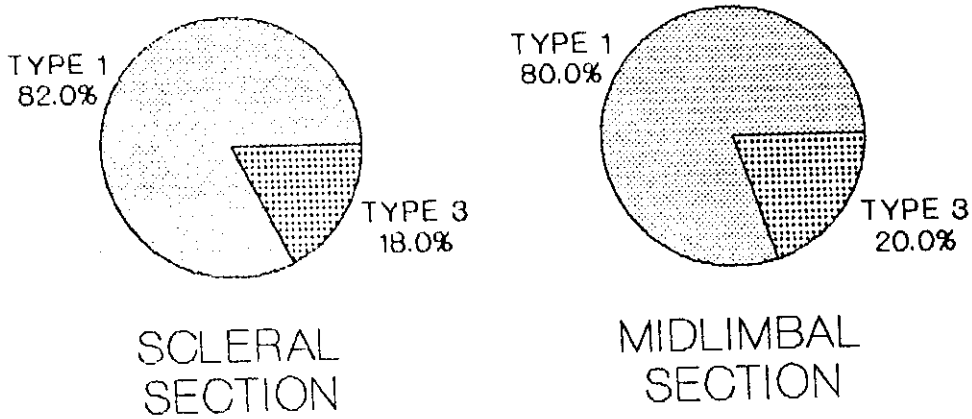


Fig.(20):TYPES OF ASTIGMATISM IN THE 2 GROUPS 1 MONTH AFTER OPERATION

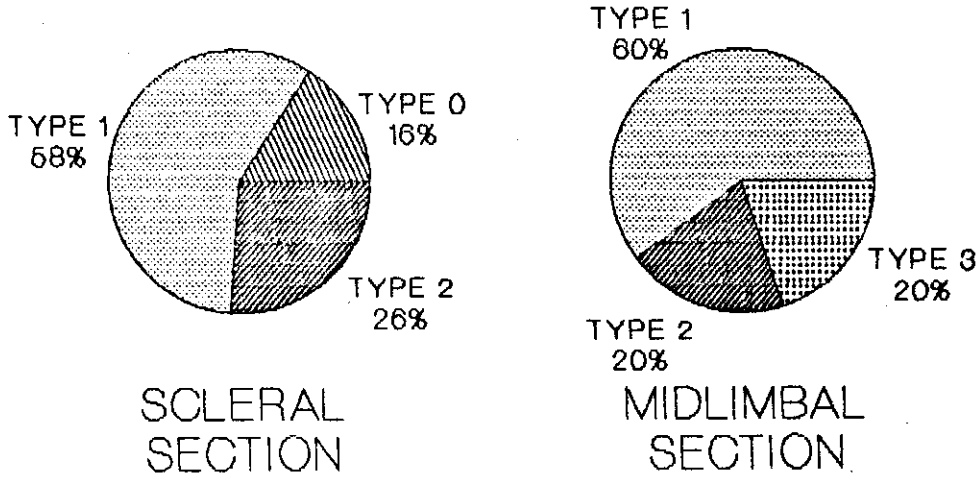


Fig.(21):TYPESOF ASTIGMATISM IN THE 2 GROUPS 2 MONTHS AFTER OPERATION

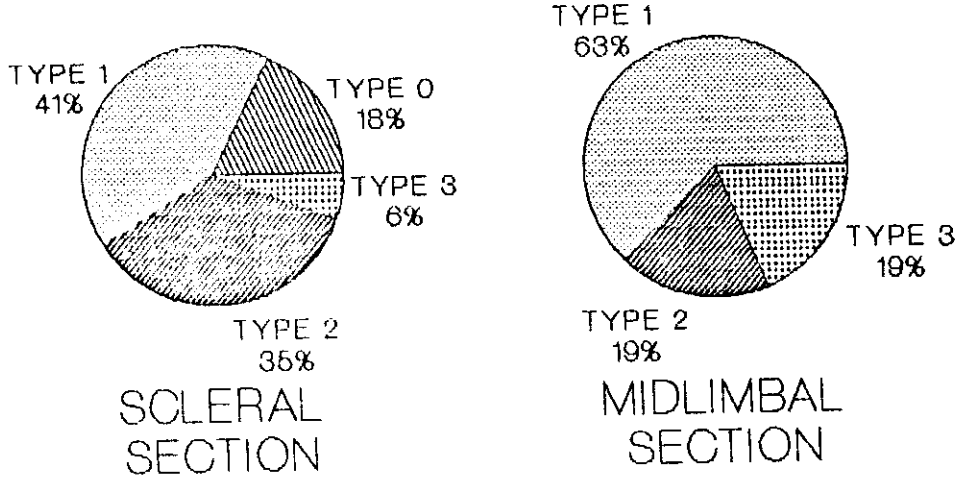
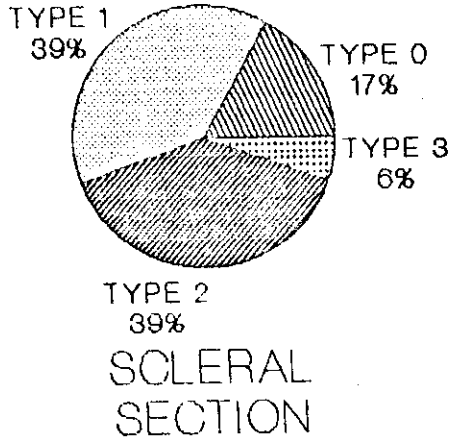
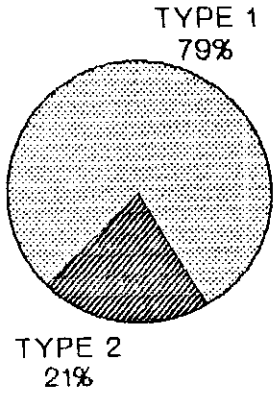


Fig.(22): TYPES OF ASTIGMATISM IN THE 2 GROUPS 3 MONTHS AFTER OPERATION



SCLERAL SECTION



MIDLIMBAL SECTION

Oblique astigmatism is observed in 5% of the cases pre-operatively. It is detected in 18% of the cases in the first week after the operation and in 6% of the cases in the second and third months after surgery.

The midlimbal group shows a different pattern of distribution of astigmatism. Sixty percent of cases have no astigmatism preoperatively, then this type disappears after the operation.

With the rule type forms 20% of the cases pre-operatively, then increase markedly after the operation to form 80% of the cases after one week. It decreases afterwards to reach 60% of the cases one month after the operation then increases again to become 63% two months after the operation and 79% three months after the operation.

Against the rule type is observed in 20% of cases preoperatively and at the first month, in 19% of the second month and in 21% of the cases in the third month.

There is no oblique astigmatism preoperatively but it appears one week and one month after the operation in 20% of the cases, and remains in 19% of cases at the second month and disappears at the third month.

It is noticed that the significant changes in types of astigmatism are mainly during the first week and to a less extent during the first month after the operation ($p < 0.0001$).

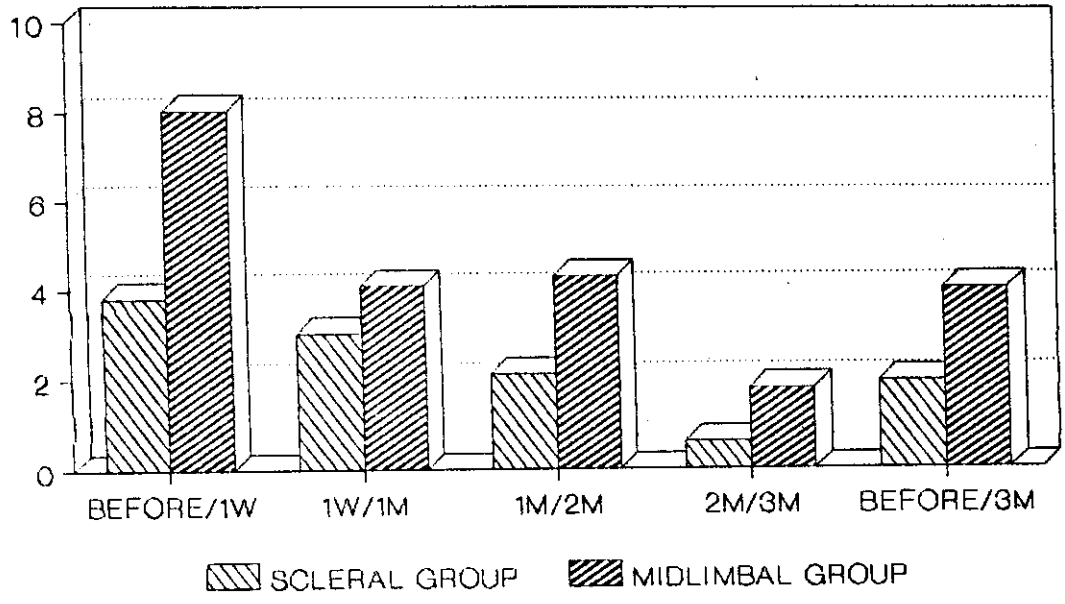
Comparison of Keratometric and manifest astigmatism during the study period shows that this difference is statistically significant.(Table 6)

In scleral group, the mean difference is 4.376 D in the first month, 2.893 D in the second month and 2.239 D in the third month. (all are statistically significant; $p < 0.001$, < 0.0001, and < 0.0001 respectively).

In midlimbal group, the mean difference is 7.735 D in the first month, 6.185 D in the second month and 5.231 D in the third month. (all are statistically significant with p values < 0.0001). It is observed that there is decrease in the difference between the two methods with increase in the follow-up period.

Fig. 23: Shows the mean change in surgically induced Keratometric astigmatism during the study period. Before surgery and one week after it is 3.8D in the scleral group and 8.06D in mid limbal group. One week and one month after it is 3.02D in scleral and 4.09 in mid limbal group. S.I.A reaches 2.1D in scleral group and 4.3D

Fig:23 THE MEAN CHANGE IN SURGICALLY-INDUCED KERATOMETRIC ASTIGMATISM DURING THE FOLLOW UP PERIOD



TABLE(A):THE MEAN CHANGE IN SURGICALLY INDUCED KERATOMETRIC ASTIGMATISM DURING THE FOLLOW UP PERIOD.

	BE.1W.AF	1W.1M.AF	1M.2M.AF	2M.3M.AF	BE.3M.AF
Scleral group	3.815	3.024	2.124	0.615	1.964
Mid limbal group	8.064	4.094	4.301	1.802	4.0213
Difference	4.245	1.069	2.177	1.186	2.056
P.Value	<0.0001	0.1	0.01	0.04	<0.0001
T.Value	4.479	1.287	2.375	1.799	3.535

BE = Before AF = After
W = Week M = Month

in mid limbal, one and two months postoperatively.

At the 2nd and 3rd month after it reaches 0.615D in the 1st group and 1.8D in the 2nd group.

S.I.A between before operation and 3 months after is 1.96D in scleral group and 4.02D in mid limbal one (Table A). Statistical comparison shows insignificant difference between the 2 groups between 1 week and 1 month after operation, ($P= 0.1$), while other differences are proved to be statistically significant ($P< 0.05$).

The best corrected visual acuity postoperatively is calculated as a measure of success of surgery. Two thirds of patients achieved visual acuity 6/6 to 6/18. A majority of the small group of patients with vision 6/36 or less had preexisting retinal disease.

In this study, selective suture cutting of tense suture is done on 8 patients (20% of cases) 2 cases from the scleral group and 6 from the midlimbal group at 6 weeks postoperatively. These cases show higher manifest astigmatism more than 2 diopters. The majority of cases improved, and a small number became worse. Description of these cases is given below.(Table 7)

TABLE (6):COMPARISON BETWEEN 'KERATOMETRIC ASTIGMATISM AND MANIFEST ASTIGMATISM DURING THE STUDY PERIOD.

	SCLERAL GROUP					MID LIMBAL GROUP				
	MEAN K ASTIGM	MEAN M ASTIGM	MEAN DIFFE.	P.	T	MEAN K ASTIGM	MEAN M ASTIGM	MEAN DIFFE.	P.	T
1.M	2.90	1.59	4.38	0.0002	4.52	6.48	1.82	7.74	0.004	6.41
2.M	2.17	0.88	2.89	0.0009	5.04	4.59	1.57	6.19	0.001	6.23
3.M	1.55	0.74	2.29	0.0003	5.22	3.94	1.29	5.23	0.001	8.040

TABLE(7):CASES OF SELECTIVE SUTURE CUTTING.THE DIFFERENCE BETWEEN K AND MANIFEST ASTIGMATISM BEFORE AND AFTER CUTTING TIGHT SUTURES.

Case number	N	BEFORE CUTTING		AFTER CUTTING	
		ASTIGMATISM	DIRECTION	ASTIGMATISM	DIRECTION
Case 4	1	K 6.287 D M -5	WITH RULE 165°	3.245 D -3	WITH RULE 20°
Case 19	2	K 6.898 D M -4	WITH RULE 180°	4.24 D -2	WITH RULE 180°
Case 23	1	K 6.369 D M -3	OBLIQUE 45°	4.957–7.48D -2	WITH RULE 20°
Case 24	1	K 10.846 D M -3	OBLIQUE 40°	8.294 D -2	WITH RULE 30
Case 27	1	K 11.993 D M -5	WITH RULE 10°	3.860 D -3	WITH RULE 180°
Case 32	3	K 8.643 D M -3	WITH RULE 170°	3.913 D -0.5	WITH RULE 180°
Case 35	2	K 13.085 D M -3	WITH RULE 10°	5.128 D -1	OBLIQUE 20°
Case 38	1	K 6.157 D M -3	WITH RULE 20°	3.714 D -2	WITH RULE 180

N = The number of tight sutures cutted

Case 4: k reading before laser was 6.287 D with the rule, manifest was - 5/165°. After laser k reading was 3.245 D with the rule, manifest was - 3/20°.

Case 19: k reading was 6.898 with the rule, manifest was - 4/180°. After laser k reading become 4.24 with the rule, manifest was - 2/180°.

Case 23: k reading was 6.369 oblique astigmatism manifest was - 3/45°. After laser k reading become 4.957 D then one week later it increase again to become 7.48 D with the rule. However,a manifest astigmatism was - 2/20°

Case 24: k reading was 10.84 D oblique, manifest was 3/40°. After laser k reading become 8.294 with the rule, manifest was - 2/30°.

Case 27: k reading was 11.993 D with the rule. manifest.was 5/10°. After laser K was 3.860 with the rule , manifest become - 3/180°.

Case 32: K reading was 8.643 with the rule, manifest was - 3/170°. After laser, K reading become 3.913 with the rule manifest was - 0.5/180°.

Case 35: K reading before was 13.085 with the rule, manifest was - 3/10°. After laser K reading become 5.128, manifest became - 1/20°.

Case 38: K reading was 6.157 with the rule,manifest was - 3/20°,after laser K reading became 3.714 with the rule manifest became - 2/180°.

Although there was wound gap in some cases of scleral section, yet this gap had no effect on the had central reading of the cornea in this case.

in case 3.Although there was wound gap at 11 o'clock the Keratometric astigmatism was Zero at one month reading. But when this gap was present in mid limbal section, much effect on K reading as in case number 35 in which there was wound gap between 1 and 2 o'clock and K astigmatism was 5.34 D, manifest was -1 D at the third month.

Also in case 38, there was wound gap after laser by 2 weeks between 10 - 12 o'clock. Pupil was rounded, K reading was 3.71 D, manifest was - 2/180 at the 2nd month.

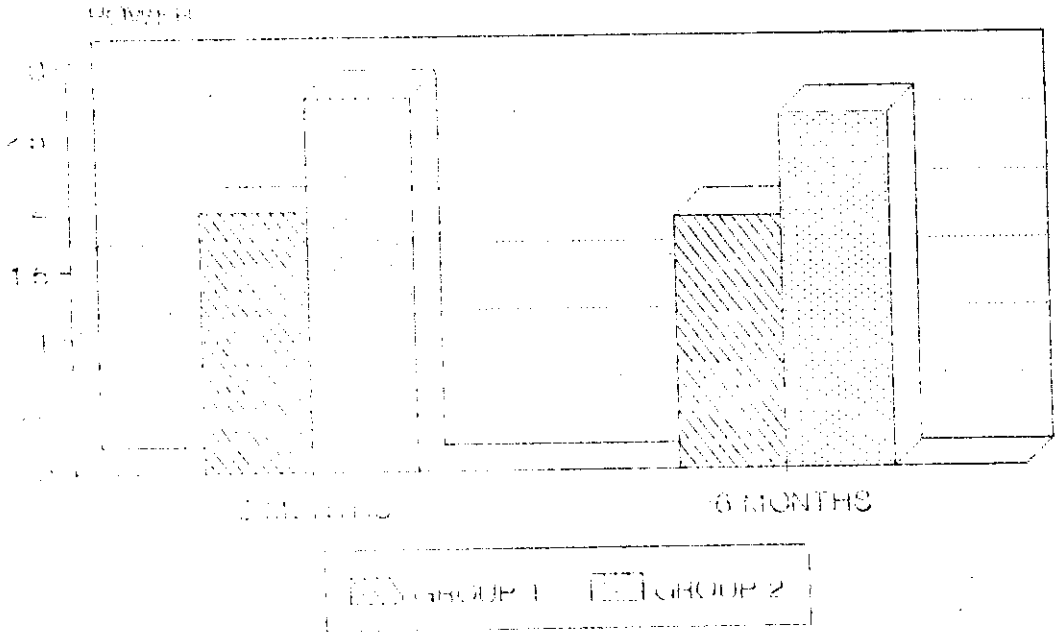
Wound revision was done in only one case, case 22 in which there was wound gap at 11 o;clock and overlapping of the wound at 1 o'clock leading to Keratometric astigmatism of 9.3 D one week after the operation we cut 3 sutures by LASER beam, 2 days later there was increase of gaping. Decision was taken to do wound revision and resuturing of the gap . This corrected astigmatism to become 3.4 D by keratometer, and only -1/20 manifest astigmatism at one month visit.

The follow up period in this study was 3 months but in 13 cases (8 scleral and 5 mid limbal) the follow up period reached up to 6 months or more. Fig (24)

The mean changes in Keratometric astigmatism in scleral group at 3 months was 1.931D while at 6 months it was 1.879D. The difference was statistically insignificant)P= 0.2). The mean S.I.A was 0.0529D (P= 0.2).

Also the mean changes in K astigmatism in mid limbal group at 3 months was 2.76D while at 6 months it was 2.621D. The difference was statistically insignificant (P= 0.09). The mean S.I.A was 0.24D (P= 0.1).

Fig.24:CHANGES IN MEAN DIOPTERIC POWER OF THE CORNEA AS DETECTED BY KERATOMETER IN CASES AT SIX MONTHS AND MORE FOLLOWUP



THE CHANGES IN KERATOMETRIC ASTIGMATISM BETWEEN THREE MONTHS,SIX MONTHS AND MORE READINGS OF SOME CASES OF SCLERAL GROUP.

CASES No.	Do/3 months	Do≥ 6months	Difference
1	3.861 D	3.861 D	0
2	0.581 D	0.581 D	0
3	0.00 D	0.00 D	0
8	3.216 D	3.216 D	0
12	0.00 D	0.315 D	0.315 D
15	2.389 D	2.033 D	0.356 D
16	2.208 D	1.827 D	0.381 D
19	3.2 D	3.2 D	0
Meane	1.931 D	1.879 D	0.131 D
t.value	-	-	0.668
P.value	-	-	0.262

THE CHANGES IN KERATOMETRIC ASTIGMATISM BETWEEN THREE MONTHS,SIX MONTHS AND MORE READINGS OF SOME CASES OF MID LIMBAL GROUP.

CASES No.	Do/ 3months	Do≥ 6months	Difference
22	3.657 D	3.657 D	0
28	1.979 D	1.166 D	0.319 D
33	0.957 D	0.957 D	0
35	5.342 D	5.342 D	0
37	1.878 D	1.492 D	0.386 D
Meane	2.762 D	2.621 D	0.141 D
t.value	-	-	1.620
P.value	-	-	0.090

TABLE (8):THE CHANGE IN KERATOMETRIC ASTIGMATISM OF BOTH GROUPS, ITS DIRECTION AND TYPE DURING THE STUDY PERIOD

No	GROUP	SERI.	DO/B	DR/B	TY/B	DO/A 1W	DR/A 1W	TY/A 1W	DO/A 1M	DR/A 1M	TY/A 1M
1	1	2	0.65	180	2	2.84	120	1.00	4.80	160.0	2.00
2	1	3	0.0	0.0	0.0	1.44	90.0	1.00	.89	90.0	1.00
3	1	4	0.0	0.0	0.0	0.97	90.0	1.00	.00	.0	.00
4	1	6	1.75	25.0	2.0	MISS	MISS	MISS	6.29	75.0	1.00
5	1	7	2.03	180	2.0	1.68	90.0	1.00	MISS	MISS	MISS
6	1	5	1.34	128	3	MISS	MISS	MISS	1.70	114.0	1.00
7	1	9	1.10	180	2	MISS	MISS	MISS	4.02	105.0	1.00
8	1	10	1.83	90	1.0	2.80	90.0	1.00	6.92	90.0	1.00
9	1	12	0.0	0.0	0.0	1.93	90.0	1.00	MISS	MISS	MISS
10	1	13	.00	.0	.00	7.48	85.0	1.00	1.29	90.0	1.00
11	1	15	.00	.0	.00	3.49	90.0	1.00	3.83	90.0	1.00
12	1	16	1.83	180.0	2.00	4.29	140.0	3.00	1.59	180.0	2.00
13	1	17	.59	90.0	1.00	2.38	90.0	1.00	.58	180.0	2.00
14	1	19	.00	.0	.00	7.93	90.0	1.00	2.29	115.0	1.00
15	1	24	.00	.0	.00	3.26	120.0	1.00	1.98	180.0	2.00
16	1	25	.00	.0	.00	4.48	145.0	3.00	.75	180.0	2.00
17	1	26	.00	.0	.00	.59	125.0	3.00	.00	.0	.00
18	1	27	.00	.0	.00	5.30	110.0	1.00	6.45	110.0	1.00
19	1	30	.00	.0	.00	9.38	90.0	1.00	6.90	90.0	1.00
20	1	40	.63	165.0	2.00	4.27	102.0	1.00	4.77	108.0	1.00
21	2	1	.98	90.0	1.00	3.13	110.0	1.00	3.62	150.0	2.00
22	2	8	.00	.0	.00	9.33	125.0	3.00	3.44	110.0	1.00
23	2	11	.97	90.0	1.00	2.88	135.0	3.00	6.37	135.0	3.00
24	2	14	1.68	180.0	2.00	9.54	125.0	3.00	10.85	130.0	3.00
25	2	18	.00	.0	.00	6.91	95.0	1.00	1.88	90.0	1.00
26	2	20	1.24	90.0	1.00	9.12	110.0	1.00	8.20	90.0	1.00
27	2	21	.00	.0	.00	12.57	100.0	1.00	11.99	100.0	1.00
28	2	22	.00	.0	.00	6.66	110.0	1.00	.97	180.0	2.00
29	2	23	.00	.0	.00	10.55	90.0	1.00	2.54	90.0	1.00
30	2	28	.00	.0	.00	8.76	90.0	1.00	6.69	90.0	1.00
31	2	29	.00	.0	.00	8.02	100.0	1.00	7.30	90.0	1.00
32	2	31	.00	.0	.00	10.25	80.0	1.00	8.64	80.0	1.00
33	2	32	.00	.0	.00	.65	90.0	1.00	.65	180.0	2.00
34	2	33	1.00	180.0	2.00	8.02	90.0	1.00	9.26	90.0	1.00
35	2	34	1.04	90.0	1.00	10.12	100.0	1.00	13.09	110.0	1.00
36	2	35	.59	180.0	2.00	6.92	90.0	1.00	3.30	180.0	2.00
37	2	36	.00	.0	.00	8.82	115.0	1.00	3.68	125.0	3.00
38	2	37	2.47	180.0	2.00	7.01	110.0	1.00	6.16	120.0	1.00
39	2	38	.00	.0	.00	13.17	105.0	1.00	11.23	110.0	1.00
40	2	39	.00	.0	.00	7.10	50.0	3.00	9.70	60.0	3.00

TABL(8):CONT.

No	DO/A 2M	DR/A 2M	TY/A 2M	DO/A 3M	DR/A 3M	TY/A 3M	DO/B/ A3	DR/B/ A3	TY/BD A3
1	3.86	160.0	2.00	3.86	170.0	2.00	3.21	170.0	2.00
2	.87	180.0	2.00	.58	180.0	2.00	.58	180.0	2.00
3	.00	.0	.00	.00	.0	.00	.00	.0	.00
4	3.25	75.0	1.00	MISS	MISS	MISS	5.00	75.00	1.00
5	.00	.0	.00	.00	.0	.00	2.03	90.00	1.00
6	MISS	MISS	MISS	1.68	114.0	1.00	3.02	114.0	1.00
7	.34	120.0	1.00	.34	120.0	1.00	1.43	90.0	1.00
8	3.71	90.0	1.00	3.22	90.0	1.00	1.39	90.0	1.00
9	.65	160.0	2.00	.65	180.0	2.00	.65	180.0	2.00
10	3.05	180.0	2.0	1.25	180.0	2.00	1.25	180.0	2.00
11	3.45	90.0	1.00	2.44	90.0	1.00	2.44	90.0	1.00
12	MISS	MISS	MISS	.00	.0	.00	1.83	90.0	1.00
13	.59	180.0	2.00	.59	180.0	2.00	1.18	180.0	2.00
14	3.61	145.0	3.00	3.90	145.0	3.00	3.96	145.0	3.00
15	3.03	180.0	2.00	2.39	180.0	2.00	2.39	180.0	2.00
16	MISS	MISS1	MISS	2.21	180.0	2.00	2.21	180.0	2.00
17	.00	.0	.00	.31	90.0	1.00	.31	90.0	1.00
18	2.95	90.0	1.00	1.34	90.0	1.00	1.34	90.0	1.00
19	4.24	90.0	1.00	3.20	90.0	1.00	3.20	90.0	1.00
20	3.85	102.0	1.00	MISS	MISS	MISS	3.85	102.0	1.00
21	3.22	140.0	3.00	2.54	120.0	1.00	1.56	120.0	1.00
22	MISS	MISS1	MISS	3.66	120.0	1.00	3.66	120.0	1.00
23	7.29	110.0	1.00	6.45	110.0	1.00	5.48	110.0	1.00
24	.29	120.0	1.00	6.71	120.0	1.00	8.40	120.0	1.00
25	1.27	90.0	1.00	1.25	90.0	1.00	1.25	90.0	1.00
26	5.93	90.0	1.00	5.58	90.0	1.00	4.34	90.0	1.00
27	3.86	90.0	1.00	3.11	90.0	1.00	3.11	90.0	1.00
28	1.62	180.0	2.00	1.98	180.0	2.00	1.98	180.0	2.00
29	MISS	MISS	MISS	3.16	90.0	1.00	3.16	90.0	1.00
30	4.18	90.0	1.00	4.18	90.0	1.00	4.18	90.0	1.00
31	6.25	80.0	1.00	5.29	80.0	1.00	5.29	80.0	1.00
32	3.91	90.0	1.00	2.56	90.0	1.00	2.56	90.0	1.00
33	1.29	180.0	2.00	.96	180.0	2.00	.96	180.0	2.00
34	10.77	100.0	1.00	8.46	105.0	1.00	9.46	105.0	1.00
35	5.13	125.0	3.00	5.34	110.0	1.00	4.31	110.0	1.00
36	MISS	MISS1	MISS	4.96	180.0	2.00	4.36	180.0	2.00
37	2.24	180.0	2.00	1.88	180.0	2.00	1.88	180.0	2.00
38	3.71	90.0	1.00	1.86	90.0	1.00	4.33	90.0	1.00
39	MISS	MISS	MISS	4.98	120.0	1.00	4.98	120.0	1.00
40	4.51	60.0	3.00	MISS	MISS	MISS	4.51	60.0	3.00

Do/B = Diopteric power before operation
Do/A1 W = Diopteric power after operation by one week.
Do/A1 M = Diopteric power after operation by one month.
Do/A2 M = Diopteric power after operation by two months.
Do/A3 M = Diopteric power after operation by three months.
DR = Direction of astigmatism
TY = Type of astigmatism
Do/B/A3 = Difference in diopteric power between before and three months after operation.

TABL(9):MANIFEST ASTIGMATISM DURING THE STUDY PERIOD

No	GROUP	DO_1	DO_2	DO_3
1	1	MISS	-0.00	-1.00
2	1	- .50	-0.50	-0.50
3	1	0.00	0.00	0.00
4	1	-5.00	-3.00	MISS
5	1	0.00	0.00	0.00
6	1	MISS	MISS	-1.75
7	1	MISS	-1.00	-1.00
8	1	-4.00	-1.00	-1.00
9	1	MISS	-1.25	0.00
10	1	-2.00	-2.00	0.00
11	1	-2.00	MISS	-1.00
12	1	-2.00	MISS	-1.00
13	1	-1.00	-0.50	-0.50
14	1	-1.00	-1.00	-2.00
15	1	-1.00	-0.50	-0.50
16	1	-0.50	MISS	-0.50
17	1	0.00	0.00	0.00
18	1	-2.00	-0.50	-0.50
19	1	-4.00	-2.00	-2.00
20	1	-2.00	MISS	MISS
21	2	0.00	0.00	0.00
22	2	-1.00	MISS	-1.00
23	2	-3.00	-2.00	-2.00
24	2	-3.00	-2.00	-2.00
25	2	0.00	0.00	0.00
26	2	-2.00	-2.00	-2.00
27	2	-5.00	-3.00	-3.00
28	2	0.00	0.00	0.00
29	2	-2.00	MISS	-2.00
30	2	MISS	MISS	-1.00
31	2	-2.00	-1.00	-1.00
32	2	-3.00	-0.50	-0.50
33	2	0.00	0.00	0.00
34	2	MISS	-5.00	-3.00
35	2	-3.00	-1.00	-1.00
36	2	-1.00	MISS	-1.00
37	2	-1.00	-2.00	0.00
38	2	-3.00	-2.00	-2.00
39	2	-3.00	MISS	-2.00
40	2	-3.00	-2.00	MISS

Do_1 =Manifest astigmatism after one month
Do_2 =Manifest astigmatism after two months
Do_3 =Manifest astigmatism after three months

TABLE (10):THE CHANGE IN SURGICALLY INDUCED KERATOMETRIC ASTIGMATISM OF BOTH GROUPS,ITS AXIS DURING THE STUDY PERIOD.

No	GROUP	DO/B 1W.AF	DR/B 1W.AF	DO/1W 1M.AF	DR/1W 1M.AF	DO/1M 2M.AF	DR/1M 2M.AF	DO/2M 3M.AF	DR/2M 3M.AF	DO/B 3M.AF	DR/B 3M.AF
1	1	3.21	114.9	5.10	176.5	0.94	159.9	1.34	119.9	3.26	168.0
2	1	1.44	90.0	0.55	90.0	1.76	90.0	0.29	90.0	0.58	90.0
3	1	0.97	90.0	0.97	90.0	MISS	MISS	0.00	0.0	0.00	0.0
4	1	MISS	MISS	MISS	MISS	3.04	165.0	MISS	MISS	3.95	92.1
5	1	3.71	90.0	MISS	MISS	MISS	MISS	0.00	0.00	2.03	90.0
6	1	MISS	MISS	MISS	MISS	MISS	MISS	MISS	MISS	1.83	178.1
7	1	MISS	MISS	MISS	MISS	3.31	103.7	0.0	0.0	1.3	173.5
8	1	0.97	90.0	4.12	90.0	3.21	90.0	0.49	90.0	1.39	90.0
9	1	1.93	90.0	MISS	MISS	MISS	MISS	0.44	125.2	0.65	90.0
10	1	7.48	175.0	6.22	173.9	4.34	90.0	1.8	90.0	1.25	90.0
11	1	3.49	90.0	0.34	90.0	0.38	90.0	0.99	90.0	2.44	90.0
12	1	4.33	142.2	4.28	140.7	MISS	MISS	MISS	MISS	1.83	90.0
13	1	1.79	90.0	2.96	90.0	0.01	90.0	0.00	0.00	1.18	90.0
14	1	7.93	90.0	6.69	172.5	3.16	164.3	0.28	143.9	3.9	145.0
15	1	3.25	119.9	4.58	108.9	1.05	90.0	0.64	90.0	2.39	90.0
16	1	4.46	145.0	4.27	140.0	MISS	MISS	MISS	MISS	2.2	90.0
17	1	0.58	125.0	0.59	125.0	0.00	0.00	0.31	90.0	0.31	90.0
18	1	5.29	109.9	1.15	110.0	4.60	122.0	1.6	90.0	1.34	90.0
19	1	9.39	90.0	2.48	90.0	2.66	90.0	1.04	90.0	3.2	90.0
20	1	4.65	98.0	1.07	136.0	1.28	127.0	MISS.	MISS.	4.25	98.56
21	2	2.46	117.4	4.35	172.5	1.25	90.0	2.07	166.0	2.52	120.5
22	2	9.30	124.9	6.58	132.0	MISS	MISS.	MISS.	MISS.	3.66	120.0
23	2	3.03	144.0	3.49	135.0	5.83	171.6	0.84	110.2	5.74	113.1
24	2	10.23	120.5	2.21	154.0	10.57	130.0	6.4	120.0	7.69	114.5
25	2	6.89	94.0	5.06	96.9	0.61	90.	0.02	90.0	1.25	90.0
26	2	8.2	112.8	5.98	140.0	2.27	90.0	0.35	90.0	4.34	90.0
27	2	12.5	99.9	0.58	100.0	8.46	104.5	0.75	90.0	3.11	90.0
28	2	6.65	109.7	7.43	107.6	0.65	90.0	0.36	90.0	1.98	90.0
29	2	10.55	90.0	8.01	90.0	MISS	MISS.	MISS.	MISS.	3.16	90.0
30	2	8.76	90.0	1.44	90.0	2.51	90.0	0.00	0.00	4.18	90.0
31	2	8.02	100.0	2.75	132.0	2.6	118.0	0.96	169.9	5.29	170.0
32	2	10.24	170.0	1.6	99.0	5.14	162.4	1.35	90.0	2.56	90.0
33	2	0.65	90.0	1.28	90.0	0.64	90.0	0.33	90.0	0.96	90.0
34	2	9.02	90.0	1.24	90.0	3.79	127.9	2.8	174.4	9.33	103.5
35	2	9.14	101.1	4.98	131.0	9.02	101.7	8.58	142.8	4.59	114.0
36	2	7.51	90.0	10.22	90.0	MISS	MISS.	MISS.	MISS.	4.37	90.0
37	2	8.8	115.0	5.49	108.0	4.92	112.3	0.36	90.0	1.88	90.0
38	2	9.03	104.9	2.43	169.9	5.36	131.7	1.84	90.0	4.33	90.0
39	2	13.16	104.9	2.87	173.6	MISS	MISS.	MISS.	MISS.	4.98	120.0
40	2	7.09	140.0	3.9	168.7	5.2	150.0	MISS.	MISS.	4.51	149.9

CASE (15):

AT THE 3rd MONTH

K = 2.3 D/180°

M = 0.5 D/90°

CASE (25):

AT THE 3rd MONTH

K = 1.25 D/90°

M = 0.0

CASE (9):

AT THE 3rd MONTH

$K = 0.63\ D/180^{\bullet}$

$M = 0.0$

CASE (22):

BEFORE WOUND REVISION

K = 9.3 D/125°

AFTER WOUND REVISION

K = 3.65 D/120°

M = 1.0 D/30°

CASE (38):

K = 3.7 D/90°

M = 2.0 D/180°

DISCUSSION

DISCUSSION

As astigmatism has become an increasingly important consideration after cataract surgery, efforts have been directed toward its reduction. The reduction of corneal astigmatism can be accomplished by understanding the course of changes in corneal curvature after surgery.

The aim of the study was to compare between two common cataract incisions, their effects on anterior corneal curvature and how to achieve the minimum astigmatic error possible with both.

Patients in this study were chosen with immature cataract so that can fix the ophthalmometer target.

The scleral and mid limbal incisions were chosen because of their popularity. The description of each was meticulously chosen during each procedure included in this study. Patients were randomly attached to the two groups which correspond to types of incision.

The backward scleral flap which was done 3.5 mm was abandoned because homeostasis which accompanied this type of incision might damage some of the anterior ciliary vessels. Also the proper deep wound closure at vertical meridian is impossible due to the distance between the beginning of scleral flap and the entrance into A.C.

In the scleral tunnel, the delivery of the nucleus is difficult as well the proper deep closure at vertical meridian is impossible. Implant of post. chamber I.O.L may be little more difficult than the usual scleral or mid limbal incision.

Nylon suture 10/0 were selected for wound closure due to their prolonged binding power, and their minimal tissue reaction.

Wound closure technique was in radial interrupted short deep bites under controlled intraocular pressure.The interruption of suture facilitates shooting of tense suture by argon LASER. Short and deep suturing minimized their effect on corneal astigmatism and prevent posterior wound gap. Suturing done under controlled intraocular pressure prevented wound edges from overlapping.

Two virgin silk were used before opening the section to prevent misalignment of wound edges. They were removed at the end of the operation.

In this study, we assessed the benefit of cutting tense suture on high astigmatism more than 2 D manifest.

The time suitable for suture cutting was chosen to be during the 6th week postoperatively. If delayed it would have been less effective due to more advanced wound healing.

This was proved by the work of PATON (1978), KWITKO and PRAEGER (1980). Also KRONISH and FORSTER (1987) reported that suture manipulation was not delayed any longer than 6 weeks to expedite visual rehabilitation.

In our study, the majority of cases improved after tense suture cutting,but 5% of the total cases did not improve may be due to overlapping of wound lips in case 23 and delaying in cutting of tense suture in case 24.

After the first week of surgery an initial vertical steepening in both groups was recorded.The mean Keratometric astigmatism was 3.7 D in scleral group and 7.8 D in mid limbal group, followed by gradual decay in that steepening to reach its minimum (1.5 D in scleral group and 3.9 D in mid limbal group 3 months after the operation).

The high astigmatism on the 1 st week may be due to surgically induced tissue edema causing more suture tension.

The incidence of with the rule astigmatism was high by the end of the 1st week. It was around 80% in both groups.

This was reported by PATON, (1978) who stated that, with posterior incision it is customary for his patients to have with the rule astigmatism in the early post-operative week.

There were no cases of against the rule astigmatism at that time. Cases with oblique astigmatism were about 20%.

One month after operation, there was reduction of keratometric astigmatism to reach 2.8 D in scleral group and 6.4 D in mid limbal one. With the rule astigmatism decreases to reach 58% and 60% in scleral and midlimbal group, while against the rule increases to reach 26% and 20% in both groups.

TERRY, (1984), reported that the cornea resists distortion but will flatten 90° away and steepens where the sutures are placed. During healing, the suture loosens allowing the cornea to resume its normal curvature.

KRONISH and FORSTER (1987) reported that steepening of the corneal curvature in the vertical meridian developed in 97% of the eye three weeks after surgery due to wound compression that cause steepening of the central cornea in the meridian of surgery.

Continuous reduction in corneal astigmatism goes on to reach its minimum level three months after the operation (1.5 D in scleral group and 3.9 D in mid limbal group).

With the rule astigmatism reached 39% in scleral group and 79% in mid limbal group.

GOULD (1974) reported that a posterior incision produces less effect on vertical meridian and small with the rule astigmatism.

TROUTMAN (1976) reported also that the closer the incision is to the cornea, the more effect the incision and healing will have on corneal curvature.

Against the rule astigmatism reached 39% in scleral group and 21% in mid limbal group. This was explained by the fact that it might be due to slight wound gap with scar formation that lead to flattening of the cornea in the meridian perpendicular on the incision.

WISHART et al (1986) reported that when monofilament was used and wound gap was allowed to occur during suturing, scar formation would develop and increased the circumference of the globe thus flattening the cornea in the meridian perpendicular to the section.

The percentage of cases with spherical cornea, preoperatively was 55% and 60 %in scleral and mid limbal group, while after three months it decreased to reach 17% in scleral group and 0% in mid limbal one. So the incidence of cases with spherical cornea was higher in scleral than mid limbal group and both were much less than before surgery. This was due to the fact that scleral section was more posterior, less effective on astigmatism than mid limbal section.

If we follow the mean change in K astigmatism in each group during the study period we find that there was a tendency toward corneal flattening. In scleral group the mean change in corneal astigmatism between before surgery and one week after was 3.3 D and between before and three months after was 1.03 D.

In mid limbal group the mean change in corneal astigmatism between before surgery and one week after was 7.3 D and between before and three months after was 3.4 D. All were statistically significant but the mean change in K astigmatism was smaller in scleral than mid limbal group.

Manifest astigmatism is astigmatism that can be measured by glasses.

In scleral group, the mean manifest astigmatism was 1.6 D, 0.9 D and 0.7 D at the 1st, 2nd and 3rd month, while in mid limbal group, it was 1.8, 1.6 and 1.3 D. The difference between the two groups was statistically significant in the 2nd and 3rd month postoperatively.

If we follow the mean change in manifest astigmatism in each group we will find that it was always decreasing. In scleral group the only significant value was between the 1st and the 3rd month, it was 0.7 D.

In mid limbal group, all values were significant between the 1st, 2nd and the 3rd months.

Manifest astigmatism was always lower than K astigmatism this was because the astigmatic effect of suture become more diluted toward the central part of the cornea.

Manifest astigmatism translates the visual results of surgery and we consider it more accurate indicator than K astigmatism as regard to the visual outcome.

It evaluates visual outcome of surgical technique. unfortunately there is no machine created to measure the central one millimeter of the cornea around the visual axis, so refraction and trial translate what happens in the central one mm around the visual axis of given patient.

We can not measure manifest astigmatism preoperatively because it has lenticular element added to corneal astigmatism so it is measured only postoperatively.

BUZARD et al., (1988) explained the difference between K astigmatism and manifest astigmatism in another way.

They said that due to remarkable resilience of human brain and the artificial condition of testing, the patient may be able to read small letters, although a significant amount of distortion and astigmatism remain. Thus subjective testing will usually give lower quantitative value for astigmatism than keratometry .

But we believe that this is a personal opinion, it is not based on any measurable data.

The followup period in this study was 3 months. This was related to the fact that stabilization of corneal curvature occurs in that period. The changes which occur after that are negligible. In 13 cases of this study the followup period reached up to 6 months or more but still the differences between 6 months and 3 months reading were very minimal and statistically insignificant. It was 1.93D at 3 months and 1.87D at 6 months in scleral group cases. The mean S.I.A was 0.0529D and also statistically non significant.

While it was 2.76D and 2.62D at the 3rd and the 6th months in mid limbal group. The mean S.I.A was 0.24D and statistically insignificant. This was agreed by the work of (BUZARD et al., 1988). Who stated that the changes in astigmatism between 10 weeks and 1 year was negligible indicating that the patient might be considered for corrective astigmatism surgery at 10 weeks. JAMPEL et al., 1987 said that the rate of decay in astigmatism has markedly diminished to 0.03D/week at 16 weeks postoperatively.