RESULTS

This study was performed in the Ophthalmology department; Benha University hospital, in the period between March 1999 and June 2001. Thirty patient, were included in this study 10 males and 20 females, and their age ranged from 45 – 75 years.

Age of patients in the corneal group ranging from 45-71 years while in the scleral group ranging from 50-75 years. The patient demographics are shown in table (3) and (4). There was no statistically significant difference in the age or sex between the two groups.

Table (3): Comparison between the studied groups as regards age.

Age	*Corneal tunnel n=20*	*Scleral tunnel n=10*
Mean	*58.30*	*63.60*
±SD	*8.87*	*7.07*
T	*1.64*	
P	*>0.05*	

Table(4):Distribution of the studied groups according to sex.

	Corneal tunnel n=20		*Scleral tunnel n=10*		*p-value@*
Sex	*No.*	*%*	*No.*	*%*	
Males	*7*	*35.0*	*3*	*30.0*	*>0.05*
• *Females*	*13*	*65.0*	*7*	*70.0*	

@=Fisher's exact test

On studying the difference maps, in the corneal tunnel group after one month it showed a minimal flattening with a mean of -0.47D (± 0.80SD). This effect disappeared after three months -0.03 D (± 0.88SD) which is statistically significant (Table 5). Most of the cases after one month showed minimal changes. Only three cases (15%)

showed mild changes. After three months the value of difference maps showed minimal changes in most cases, but marked changes occurred in one case (5%), where the noticeable previous flattening disappeared. In one case (5%), the net mild steepening of the central area increased (from 1.83 D after one month to 2.90 D after three months).

Table(5):Comparison between preoperative and one month postoperative vs preoperative and three months postoperative difference map in Corneal Tunnel Group.

	Preoperative and one month	***Preoperative and three months***
Mean	***-0.47***	***0.03***
±SD	***0.80***	***0.88***
Z	***2.80***	
P	***<0.01****	

z=Wilcoxon Matched-Pairs Signed-Ranks Test ****Significant***

In the scleral group, after one month the value of the difference maps showed no or minimal changes in most cases with a mean of -0.01 D (± 0.55 SD).

Only one case (10%), showed net mild changes. After three months the value of the difference maps showed, also no or minimal changes. The mean was –0.15 D (± 0.54 SD) which is statistically insignificant compared to the value of the one month postoperatively (Table 6).

Table(6):Comparison between preoperative and one month postoperative vs preoperative and three months postoperative difference map in Scleral Tunnel Group.

	Preoperative and one month	***Preoperative and three months***
Mean	***-0.01***	***-0.15***
±SD	***0.55***	***0.54***
Z	***0.62***	
P	***>0.05***	

z=Wilcoxon Matched-Pairs Signed-Ranks Test

On studying the scalar value of the corneal astigmatism in the corneal group, the mean of the preoperative astigmatism was 0.81 D (± 0.62 SD). After one month, the mean was 1.56 D (± 0.94 SD) and after 3 months the mean was 1.02 D (± 1.01 SD). The mean of surgically induced astigmatism after one month was 0.65 D which is statistically significant (P < 0.001). The mean of SIA after three months was 0.21 D which is statistically insignificant (P > 0.05). The changes in astigmatic value from one month to three months was statistically significant (P < 0.001). (Table 7; fig. 34).

Table(7):Comparison between preoperative and postoperative value of corneal astigmatism in Corneal Tunnel Group.

	Preoperative	***One month postoperative***	***Three months postoperative***
Mean	***0.81***	***1.56***	***1.02***
±SD	***0.62***	***0.94***	***1.01***

Paired t-test

Preoperative	***vs.***	***1m postoperative***	***t=4.72***	***p<0.001****
Preoperative	***vs.***	***3m postoperative***	***t=1.44***	***p>0.05***
1m postoperative	***vs.***	***3m postoperative***	***t=4.59***	***p<0.001****

- ***significant***

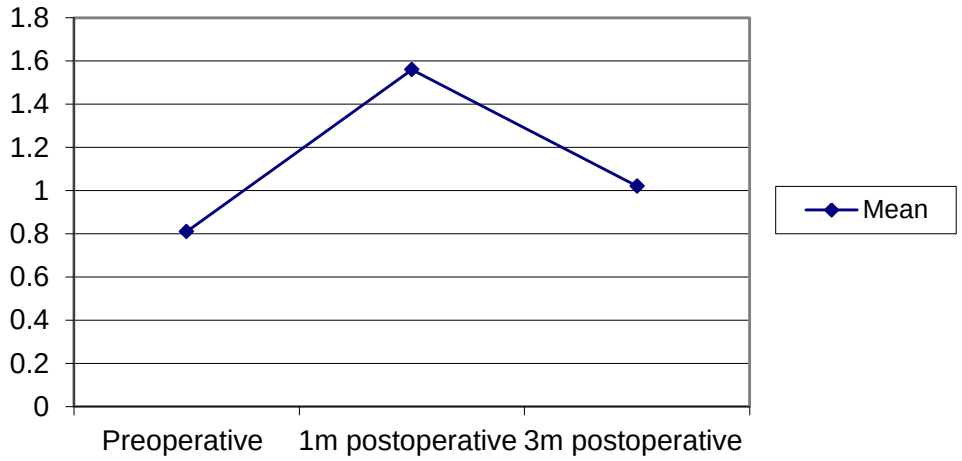


Fig.(34): Comparison between preoperative and postoperative value of corneal astigmatism in Corneal Tunnel Group.

The value of astigmatism in scleral group, preoperatively the mean was 0.56 D (± 0.36 SD), after one month, the mean was 0.82 D (± 0.45 SD), and after three months the main was 0.74 D (± 0.42 SD). The mean of SIA after one month was 0.26 D which is statistically insignificant, the mean of SIA after three months was 0.18 D, Also statistically is insignificant. The changes from one month to three months was 0.08 D which is statistically insignificant (Table 8; fig. 35).

Table(8):Comparison between preoperative and postoperative value of corneal astigmatism in Scleral Tunnel Group.

	Preoperative	***One month postoperative***	***Three months postoperative***
Mean	***0.56***	***0.82***	***0.74***
±SD	***0.36***	***0.45***	***0.42***

Paired t-test

Preoperative	***vs.***	***1m postoperative***	***t=1.72***	***p>0.05***
Preoperative	***vs.***	***3m postoperative***	***t=1.72***	***p>0.05***
1m postoperative	***vs.***	***3m postoperative***	***t=0.62***	***p>0.05***

**** significant.***

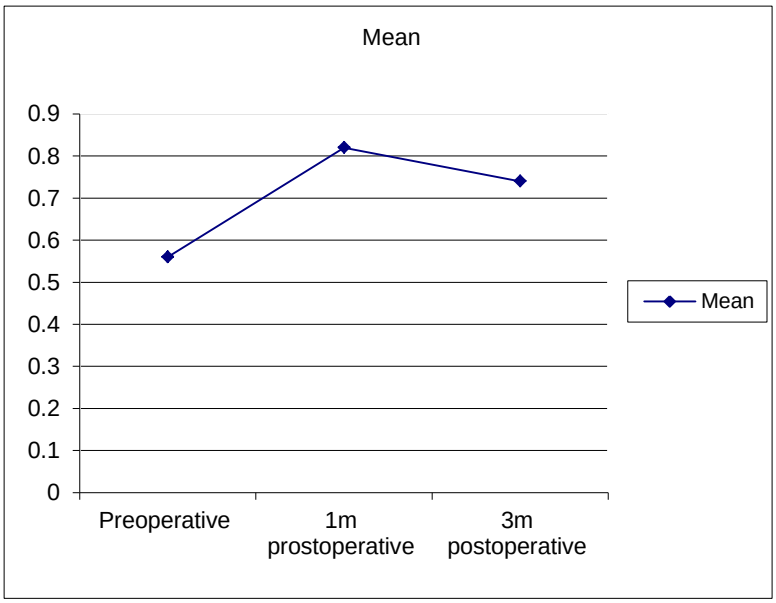


Fig.(35):Comparison between preoperative and postoperative value of corneal astigmatism in Scleral Tunnel Group.

There was no statistically significant changes in the axes degrees between the preoperative and postoperative axes in both groups.

- **Axis changes in the corneal tunnel group; fig. (36)**

(a) After one month $\leq 30^{o}$ = 90%

$> 30^{o}$ = 10%

(b) After three months $\leq 30^{o}$ = 90%

$> 30^{o}$ = 10%

- **Axis changes in the scleral tunnel group; fig. (36)**

(a) after one month $\leq 30^{o}$ = 50%

$> 30^{o}$ = 50%

(b) after three months $\leq 30^{o}$ = 70%

$> 30^{o}$ = 30%

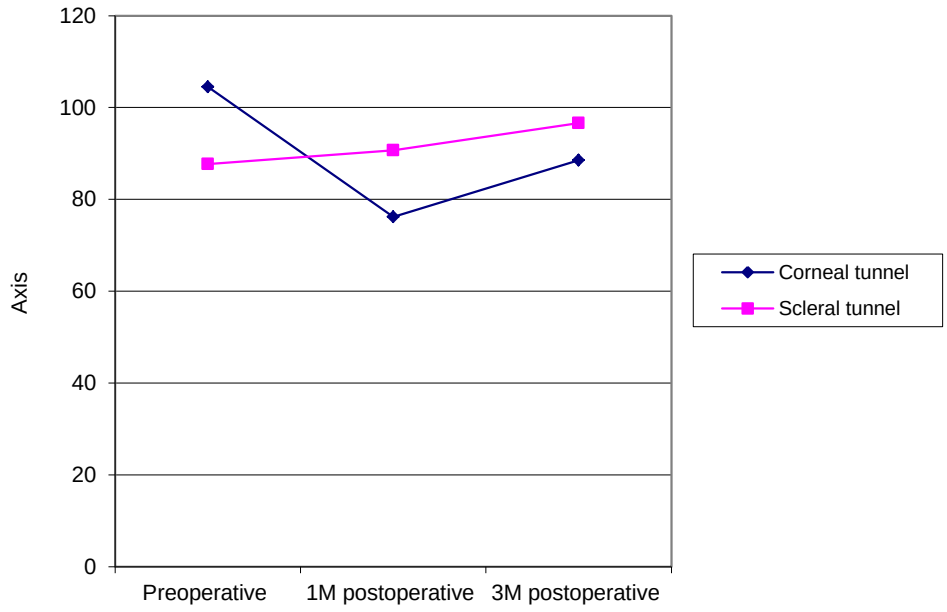


Fig. (36) : Comparison between Axis changes in scleral tunnel group and clear corneal tunnel group.

Visual acuities were significantly improved in both corneal and scleral groups after one and three months (Table 9,10,11 & 12 and fig. 37 & 38).

Table (9) : Comparison between preoperative and postoperative UCVA in Corneal Tunnel group

VA	Preoperative		One month postoperative		Three months postoperative	
	No.	%	No.	%	No.	%
HM	1	5.0	0	0.0	0	0.0
CF	2	10.0	0	0.0	0	0.0
1/60	6	30.0	0	0.0	0	0.0
2/60	3	15.0	0	0.0	0	0.0
3/60	2	10.0	0	0.0	0	0.0
5/60	4	20.0	0	0.0	0	0.0
6/60	2	10.0	0	0.0	0	0.0
6/36	0	0.0	5	25.0	4	20.0
6/24	0	0.0	10	50.0	6	30.0
6/18	0	0.0	2	10.0	6	30.0
6/12	0	0.0	3	15.0	4	20.0
Total	20	100.0	20	100.0	20	100.0

Wilcoxon Matched – Pairs Signed – Ranks Test

Preoperative	*vs. 1m postoperative*	*z = 3.92*	*p<0.001**
Preoperative	*vs. 3m postoperative*	*z = 3.92*	*p<0.001**
1 m preoperative	*vs. 3m postoperative*	*z = 2.20*	*p<0.05**

**Significant*

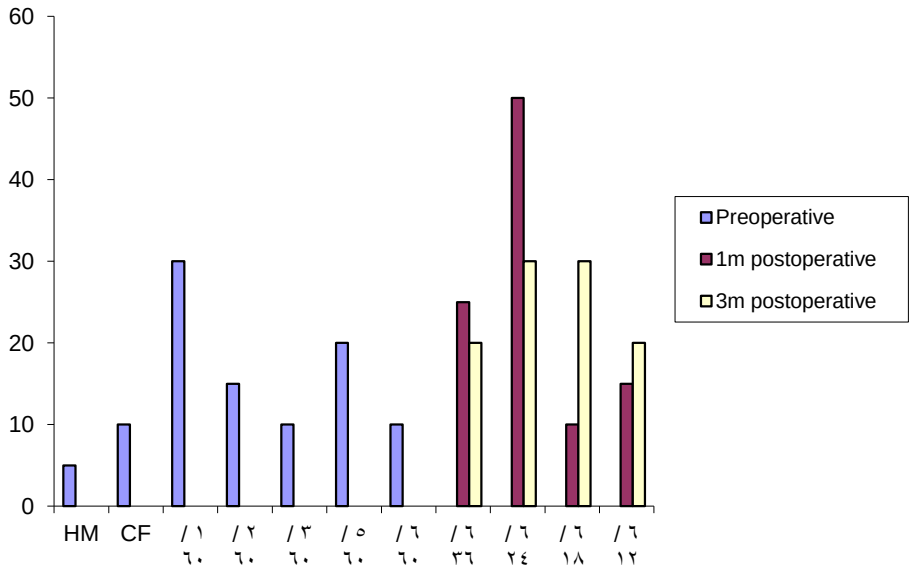


Fig. (37) : Comparison between preoperative and postoperative UCVA in Corneal Tunnel group.

Table (10) : Comparison between preoperative and postoperative UCVA in Scleral Tunnel group

VA	Preoperative		One month postoperative		Three months postoperative	
	No.	%	No.	%	No.	%
1/60	1	10.0	0	0.0	0	0.0
2/60	1	10.0	0	0.0	0	0.0
3/60	0	0.0	0	0.0	0	0.0
5/60	0	0.0	0	0.0	0	0.0
6/60	6	60.0	0	0.0	0	0.0
6/36	2	20.0	3	30.0	2	20.0
6/24	0	0.0	1	10.0	1	10.0
6/18	0	0.0	2	20.0	1	10.0
6/12	0	0.0	4	40.0	2	20.0
6/9	0	0.0	0	0.0	4	40.0
Total	10	100.0	10	100.0	10	100.0

Wilcoxon Matched – Pairs Signed – Ranks Test

Preoperative	*vs. 1m postoperative*	*z = 2.80*	*p<0.01**
Preoperative	*vs. 3m postoperative*	*z = 2.80*	*p<0.01**
1 m preoperative	*vs. 3m postoperative*	*z = 2.52*	*p<0.05**

**Significant*

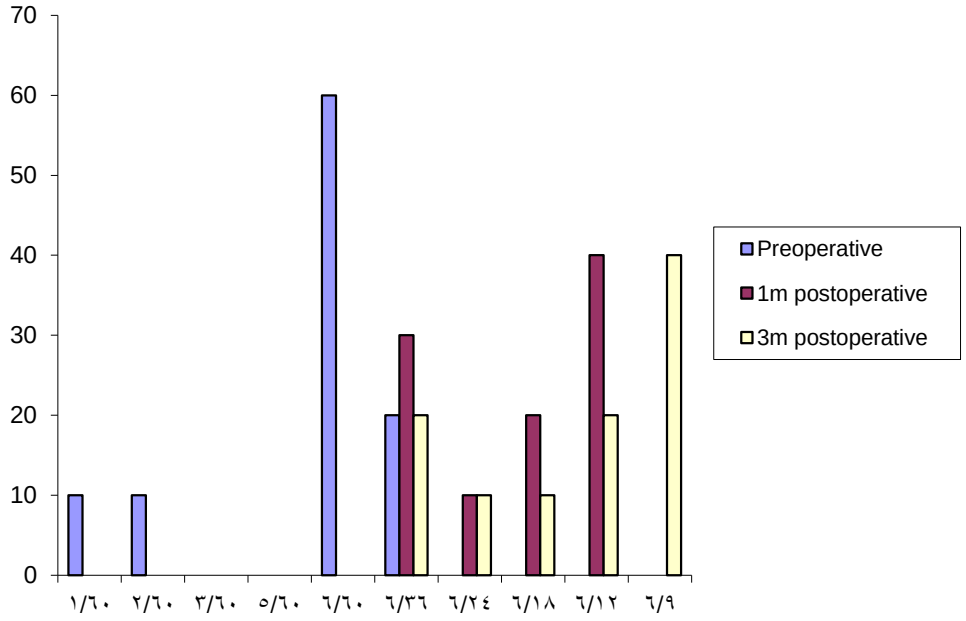


Fig. (38) : Comparison between preoperative and postoperative UCVA in Scleral Tunnel group

Table(11):Comparison between preoperative and postoperative BCVA in Corneal Tunnel Group.

	Preoperative		*One month postoperative*		*Three months postoperative*	
VA	***No.***	***%***	***No.***	***%***	***No.***	***%***
HM	***1***	***5.0***	***0***	***0.0***	***0***	***0.0***
CF	***1***	***5.0***	***0***	***0.0***	***0***	***0.0***
2/60	***1***	***5.0***	***0***	***0.0***	***0***	***0.0***
3/60	***2***	***10.0***	***0***	***0.0***	***0***	***0.0***
5/60	***2***	***10.0***	***0***	***0.0***	***0***	***0.0***
6/60	***7***	***35.0***	***0***	***0.0***	***0***	***0.0***
6/36	***4***	***20.0***	***0***	***0.0***	***0***	***0.0***
6/24	***1***	***5.0***	***2***	***10.0***	***2***	***10.0***
6/18	***1***	***5.0***	***3***	***15.0***	***1***	***5.0***
6/12	***0***	***0.0***	***7***	***35.0***	***2***	***10.0***
6/9	***0***	***0.0***	***4***	***20.0***	***6***	***30.0***
6/6	***0***	***0.0***	***4***	***20.0***	***9***	***45.0***
Total	***20***	***100.0***	***20***	***100.0***	***20***	***100.0***

Wilcoxon Matched-Pairs Signed-Ranks Test

Preoperative	***vs.***	***1m postoperative***	***z=3.92***	***p<0.001****
Preoperative	***vs.***	***3m postoperative***	***z=3.92***	***p<0.001****
1m postoperative	***vs.***	***3m postoperative***	***z=2.67***	***p<0.01****

****Significant***

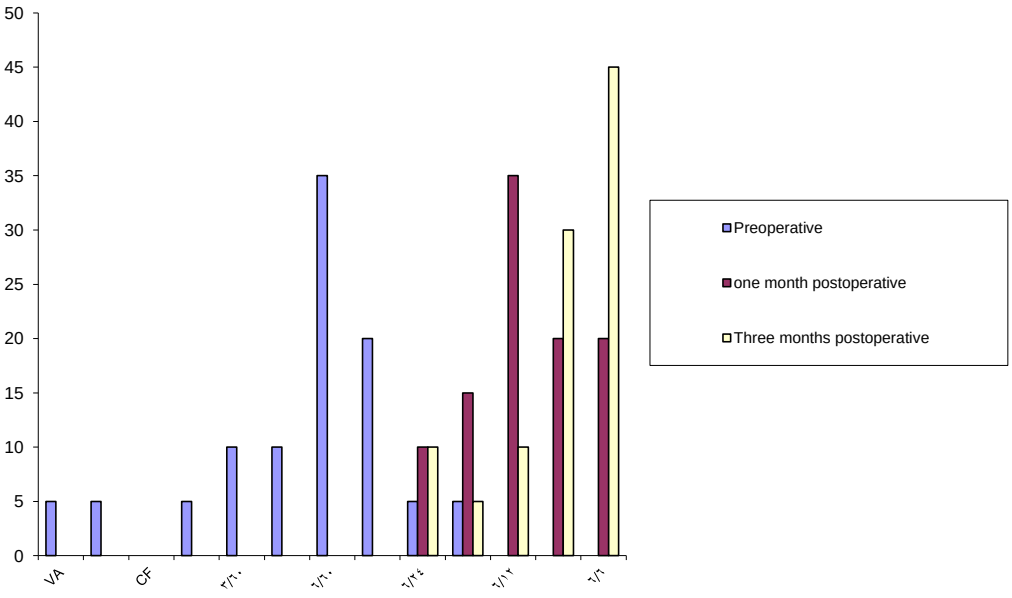


Fig. (38A):Comparison between preoperative and postoperative BCVA in Corneal Tunnel Group.

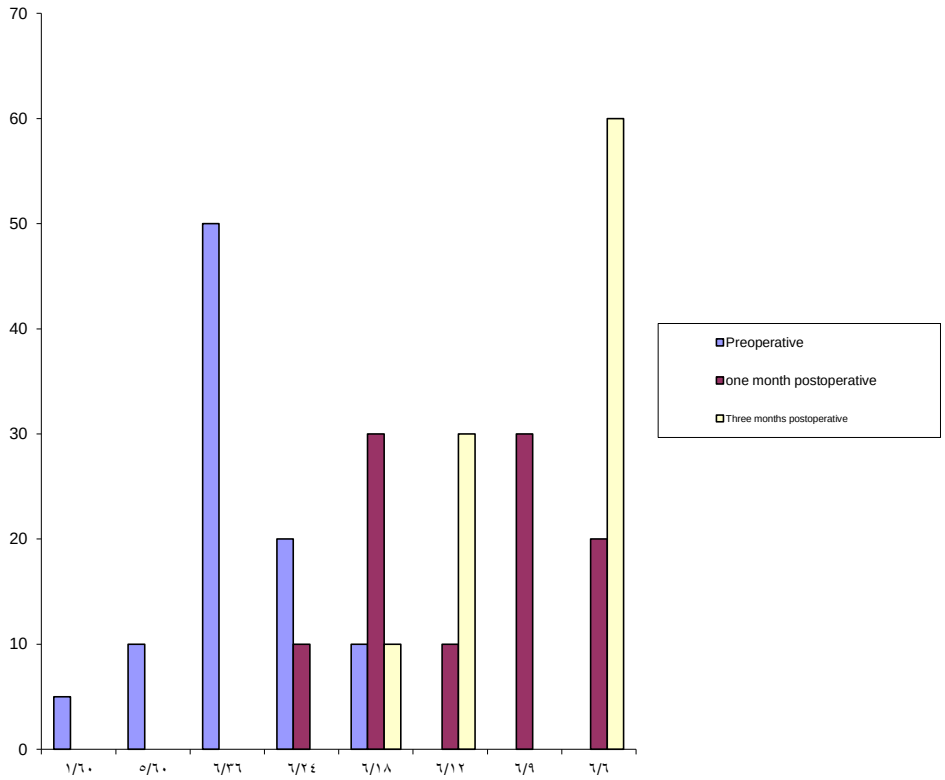
Table(12): Comparison between preoperative and postoperative BCVA in Scleral Tunnel Group.

	Preoperative		One month postoperative		Three months postoperative	
VA	No.	%	No.	%	No.	%
1/60	1	5.0	0	0.0	0	0.0
5/60	1	10.0	0	0.0	0	0.0
6/36	5	50.0	0	0.0	0	0.0
6/24	2	20.0	1	10.0	0	0.0
6/18	1	10.0	3	30.0	1	10.0
6/12	0	0.0	1	10.0	3	30.0
6/9	0	0.0	3	30.0	0	0.0
6/6	0	0.0	2	20.0	6	60.0
Total	10	100.0	10	100.0	10	100.0

Wilcoxon Matched-Pairs Signed-Ranks Test

Preoperative	***vs.***	***1m postoperative***	***z=2.80***	***p<0.01****
Preoperative	***vs.***	***3m postoperative***	***z=2.80***	***p<0.01****
1m postoperative	***vs.***	***3m postoperative***	***z=2.52***	***p<0.05****

****Significant***



Table(38B): Comparison between preoperative and postoperative BCVA in Scleral Tunnel Group.

On comparison between the corneal tunnel group and scleral tunnel group as regards the value of the difference map, it was found that after one month the difference was statistically significant (P < 0.05) (Table 13).

Table(13): Comparison between the studied groups as regards value of difference map.

	Corneal tunnel N=20		***Scleral tunnel n=10***		***z***	***p***
	Mean	***±SD***	***Mean***	***±SD***		
Preoperative and one month postoperative	***-0.47***	***0.80***	***-0.01***	***0.55***	***1.98***	***<0.05****
Preoperative and three months postoperative	***0.03***	***0.88***	***-0.15***	***0.54***	***0.75***	***>0.05***

z=Mann-Whitney test

After three months the difference between the two groups was insignificant (P > 0.05).

Comparison between the two groups regarding the value of corneal astigmatism, preoperatively and three months postoperatively proved that there was no statistically significant difference. But after one month postoperatively there was a statistically significant difference between the two groups (P < 0.05) (Table 14) fig. (39).

Table(14): Comparison between the studied groups as regards value of corneal astigmatism.

	Corneal tunnel n=20		*Scleral tunnel n=10*		*t*	*p*
	Mean	*±SD*	*Mean*	*±SD*		
Preoperative	***0.81***	***0.62***	***0.56***	***0.36***	***1.16***	***>0.05***
One month post-operative	***1.56***	***0.94***	***0.82***	***0.45***	***2.34***	***<0.05****
Three months postoperative	***1.02***	***1.01***	***0.74***	***0.42***	***0.85***	***>0.05***

****Significant***

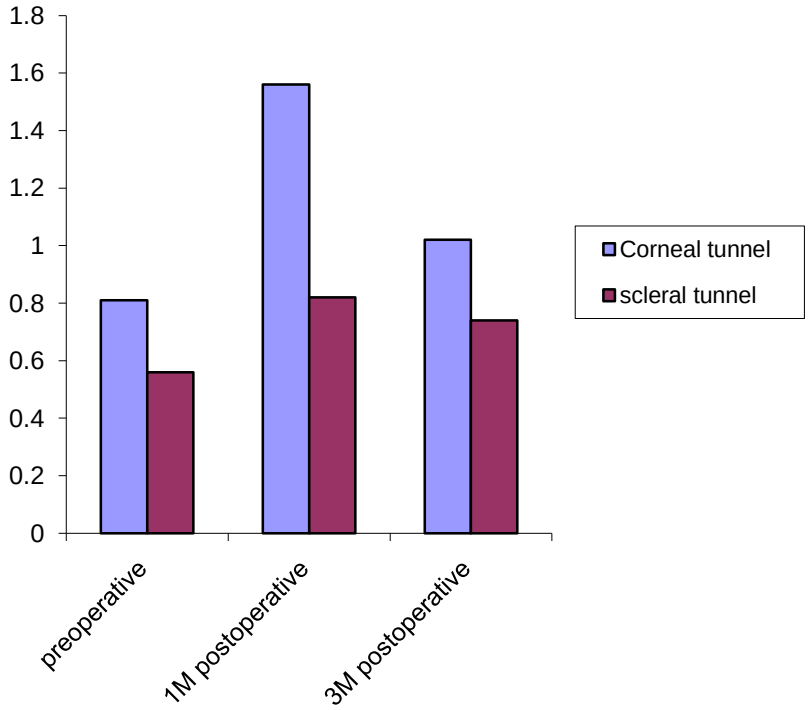


Fig.(39): Comparison between the studied groups as regards value of corneal astigmatism.

Table (15) : Surgically induced astigmatism (SIA) by simple subtraction method in the two groups.

	Corneal tunnel		*Scleral tunnel*	
	Mean	*± SD*	*Mean*	*± SD*
One month postoperative	*0.65*	*0.51*	*0.26*	*0.23*
Three month postoperative	*0.21*	*0.20*	*0.18*	*0.21*

- **The difference maps of the corneal tunnel group showed that,**

(a) after one month;

65% of the cases showed mild net flattening.

35% of the cases showed, little or no changes.

55% of the cases showed less than 0.5 D change.

85% of the cases showed less than 1.0 D change.

95% of the cases showed less than 1.5 D change.

All the cases showed less than 2.37 D change.

(b) after three month,

60% mild net flattening.

40 % little or no changes (Little changes either flattening or steepening).

60% of the cases showed less than 0.5 change.

85 % of the cases showed less than 1.0D change.

95% of the cases showed less than 1.5D change.

All the cases showed less than 2.9D change.

- **The difference maps of the scleral tunnel group showed that,**

  (a) After one month, all cases ranging from little flattening, no changes, to little steepening.

  70% of the cases showed less than 0.5D change.
  All the cases showed less than 1.0D change.

  (b) After three months, all the cases ranges from little flattening, no changes, to little steepening.

  60% of the cases showed less than 0.25D change.
  90% of the cases showed less than 1.0 D change.
  All the cases showed less than 1.25 D changes.

Also, there was no statistically significant difference between the two groups as regards the axis degree changes postoperatively.

On comparison between the two groups as regards BCVA after one and three months, there was no statistically significant difference ($P > 0.05$) (Table 16 & 17).

Table (16): Comparison between the studied groups as regards BCVA (one month postoperative).

	Corneal tunnel		*Scleral tunnel*	
VA	*No.*	*%*	*No.*	*%*
6/24	*2*	*10.0*	*1*	*10.0*
6/18	*3*	*15.0*	*3*	*30.0*
6/12	*7*	*35.0*	*1*	*10.0*
6/9	*4*	*20.0*	*3*	*30.0*
6/6	*4*	*20.0*	*2*	*20.0*
Total	*20*	*100.0*	*10*	*100.0*

Mann-Whitney test

z=0.09 p>0.05

Table(17): Comparison between the studied groups as regards BCVA (three months postoperative).

	Corneal tunnel		*Scleral tunnel*	
VA	*No.*	*%*	*No.*	*%*
6/24	*2*	*10.0*	*0*	*0.0*
6/18	*1*	*5.0*	*1*	*10.0*
6/12	*2*	*10.0*	*3*	*30.0*
6/9	*6*	*30.0*	*0*	*0.0*
6/6	*9*	*45.0*	*6*	*60.0*
Total	*20*	*100.0*	*10*	*100.0*

Mann-Whitney test

z=0.36 p>0.05

Complications

Three cases (15%) of the corneal group showed mild edema early after surgery which disappeared in the second day. Edema was less in the scleral group. In one case (5%) of the corneal group, edema disappeared after few days. One case (10%) of the scleral group showed mild to

moderate corneal edema which disappeared after one week. In general, corneal edema always transient and limited to the area around the corneal tunnel.

Two cases (10%) of the corneal group showed mild to moderate reaction which disappeared after few days.

One case (5%) of corneal group showed increased IOP in the 1st day (24.0mmHg compared to 12.0 mmHg preoperatively). Which treated by Timolol 0.5% eye drops twice daily for 3 days.

One case (5%) of the scleral group had a small posterior capsular hole, but the lens was centralized in the bag. No leakage or another anterior segment complications. No retinal complications occurred in any patients during the follow-up period.

The following are examples for the studied groups including, in most cases, the difference maps, keratometric reading, semimeridian data, and astigmatic torque. Each group has a different serial numbers.

N.B. In spite that the shape and the value of the difference maps, in general, were within average range, there were detailed difference among different maps. These small detailed changes were unpredictable and couldn't be detected by simple methods as keratometry. So, this study presented many of these maps to show these small unpredictable changes.