RESULTS

This study was performed at the ophthalmology Department Benha unsiversity Hospital including twenty eyes of twenty patients with horizontal strabismus , all of them underwent one of the horizontal muscle surgeries. The age of the patients ranged between 8 and 28 years with a mean age 18.4 ± 6-31 S D ***(table 1)*** 6 cases were males and 14 were females. The ratio was 3:7***(fig. 18).***

6 cases presented by exotropia while 14 cases presented by esotropia with ratio of 3 :7 ***(fig. 19)***.

The cases of the study according to surgical procedures, were classified into 3 groups ***(table2)***

Group (A) :

Included 12 cases underwent double muscle surgery (resection – recession procedure) and further subdivided into two subgroups :

(A_1): Included 6 cases underwent medial rectus muscle recession and lateral rectus muscle resection**.**

(A_2): Included 6 cases underwent medial rectus muscle resection and lateral rectus muscle recession**.**

Group (B):

Included 6 cases underwent lateral rectus muscle resection.

Group (C) :

Included two cases underwent medial rectus muscle recession.

Table(1) age distribution among studied group patients :

Age range	No . of cases	Percentage
1-10	4	20%
10-20	8	40%
20-30	8	40%
Total	20	100%

Table (2) types of operations among studied group patients

	Type of operation	No. of Cases	Percentage
Group (A1)	L.R .resection& M.R recession	6	30%
Group (A2)	L.R recession& M.R. resection	6	30%
Group (B)	L.R . resection	6	30%
Group (C)	M.R recession	2	10 %

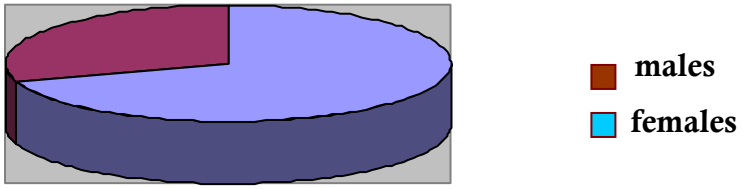

Fig. (18) sex distribution of the studied group.

30% males

70% females

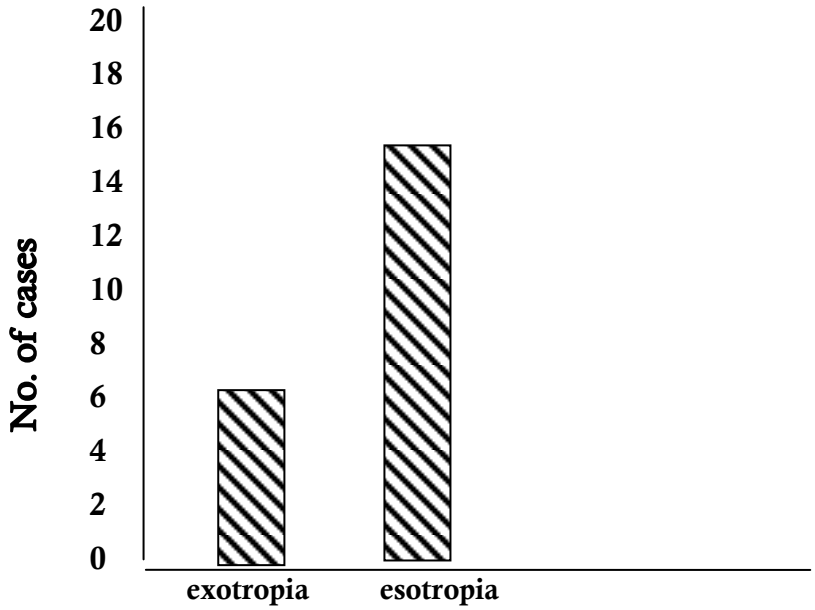

Fig. (19) types of strabismus

In group (A_1) :

As regards topographic changes in the steep and flat meridians and sim K measured by orbscan:

All eyes in this group showed at the end of follow up period vertical steeping and with the rule astigmatism in an axis ranging between 80 and 120 .

At that time patients showed non significant difference (P>0.05) in the mean power of astigmatism, both in the steep (44.2±1.15 D) and flat (41.50±1.62 D) meridians compared to the preoperative mean power measures in both meridians (43.85±1.2D and 41.35±1.5 D) respectively. Despite the significant (P < 0.05) difference of the mean power of steep meridian recorded at one week postoperatively (45.96±1.65 D) compared to preoperative measures ***(table3 ,fig 20)***.

The sim K at two months (2.7+1.5D) showed a non significant difference (P>0.05) compared to preoperative measure (2.5+1.52D) ***(table3 ,fig 21)***.

Table (3) the mean diopteric power changes of the steep and flat meridians and sim K astigmatism in the group(A1)

Type of astigmatism	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o D.P	Two months mean p.o D.P
Mean diopteric power of steep meridian	43.85±1.20	45.96±1.65 *	45.15± 0.73	44.20± 1.15
Mean diopteric power of flat meridian	41.35±1.50	43.00± 2.65	42.32±2.21	41.50±1.62
Mean sim K	2.51±1.52	2.96±1.32	2.83±1. 97	2.70±1.40

**** significant D.P: diopteric power P.O: postoperative***

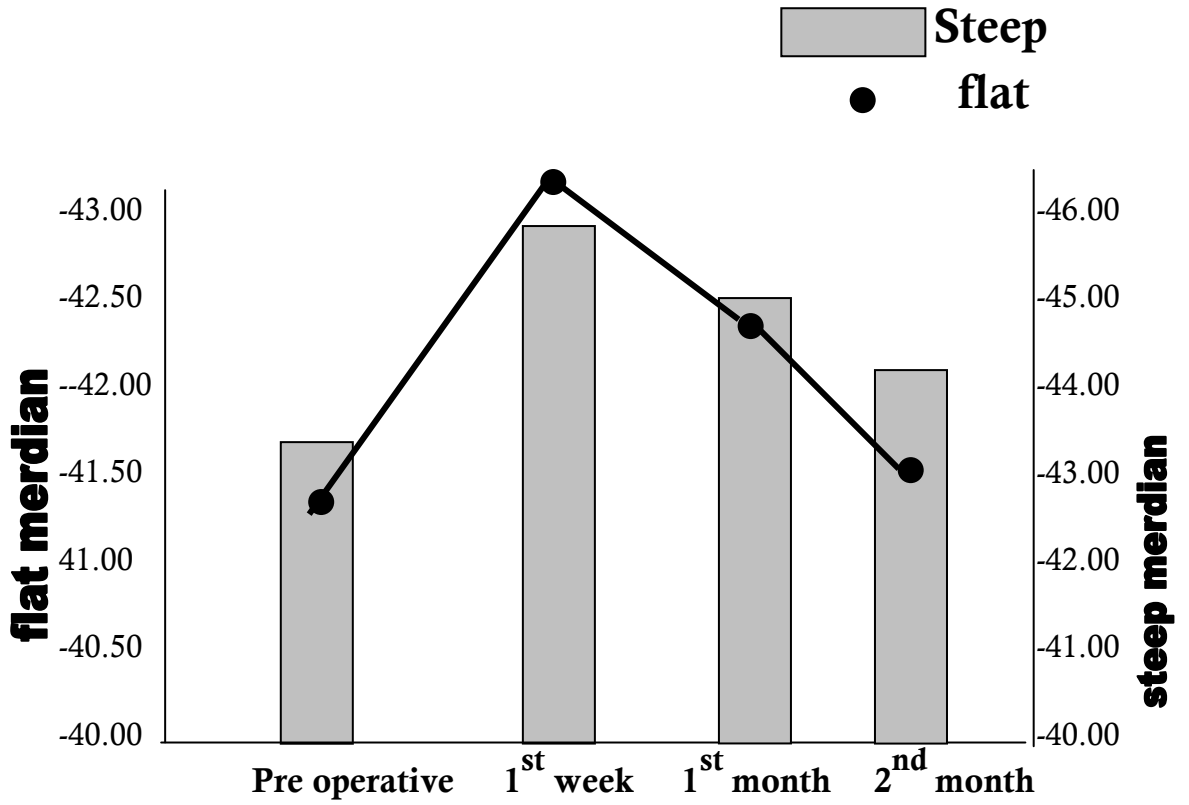

Fig (20) Changes in the mean diopteric power of the steep and flat meridians in group (A1) .

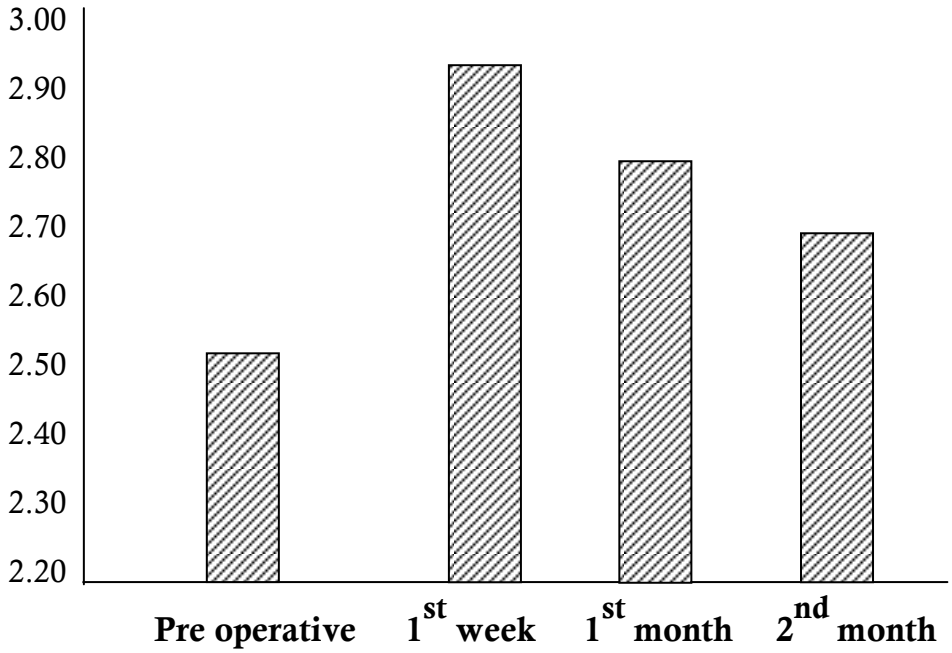

Fig. (21) the changes in mean sim K astigmatism in group (A_1)

As regard the topographic changes of the central 3 mm zone:

The mean preoperative diopteric power was 42.60±2.51D increased to 44.73±0.33Done week postoperatively and reduced to 43.60±0.42D and 42.7 ±0.35D one and two months postoperatively respectively.

The changes at one week postoperatively were statistically significant ($p<0.05$) while others were not ($P>0.05$) ***(table5) (fig22).***

Table(5): the mean diopteric power changes in central 3mm zone in group (A1)

	Mean Preoperative D.P	One week mean p.o. D.P	One month mean p.o. D.P	Two months mean p.o. D.P
Mean Power±S D	42.60 ± 0.51	44.73± 0.33 *	43.60 ± 0.42	42.7± 0.35

** significant D.P: diopteric power P.O: postoperative*

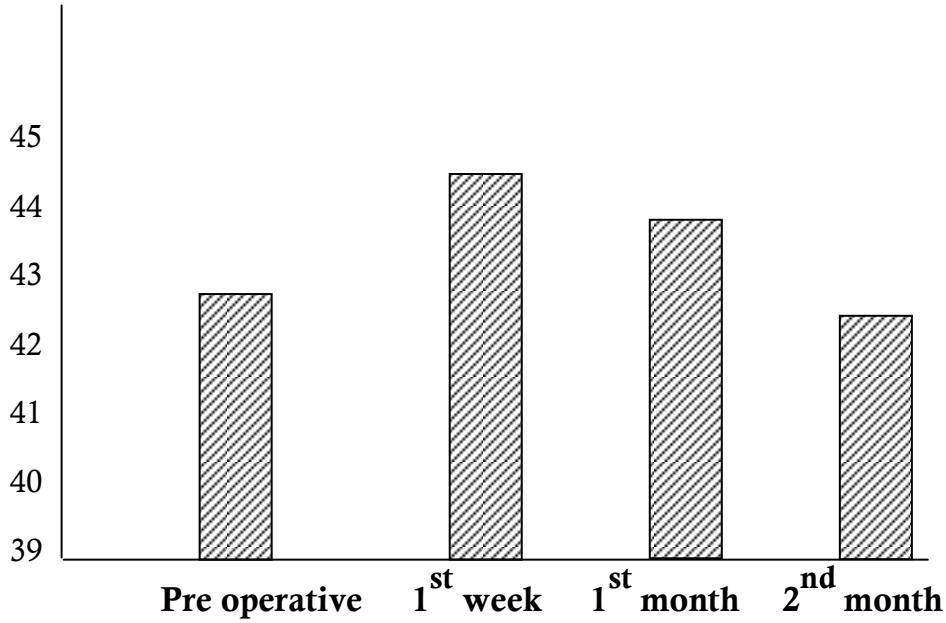

Fig (22) : the mean diopteric power changes in central 3mm zone in group (A1)

As regard the topographic changes in the peripheral area opposite the recti muscles :

The mean preoperative diopteric power in the peripheral area opposite the medial rectus muscle was 39.33+1.34D reduced to 34.66 ±1.21 D one week postoperatively and increased to 36.33 ±1.34D and 36.83 ±1.34D at one and two months postoperatively respectively.

The only statistically significant changes were at one week postoperatively (P< 0.05) while others were not (P>0.05) ***(table 6)***

(fig . 23).

The mean Preoperative diopteric power in the peripheral area opposite the lateral retcus muscle was 38.16 ± 1.34 D increased to 40.83+1.80 D and reduced to 39.83±1.97Dand 38.83 ± 0.49 D at one and two months postoperatively respectively.

These change were statistically significant in all readings (P<0.05) ***(Fig.24) (table 7)*** .

Table (6) the mean diopteric power changes in the peripheral area opposite the medial rectus muscle

	Mean Preoperative D.P	One week mean p.o. D.P	One month mean p.o. D.P	Two months mean P.o D.P
Mean power±S D	39.33± 1.34	34.66±1.21 *	36.33 ±1.34	36.83 ±1.34

** significant* *D.P: diopteric power* *P.O: postoperative*

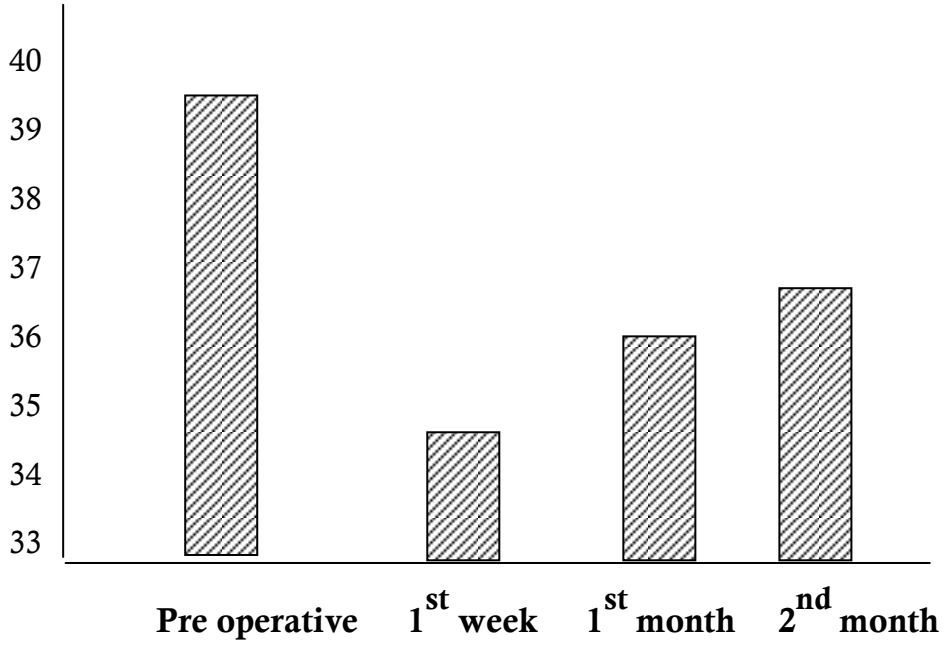

Fig (23) the mean diopteric power changes in the peripheral area opposite medial rectus muscle in group (A1).

Table (7) the mean diopteric power changes in the peripheral area opposite lateral rectus muscle

	Mean Preoperative D.P	One week mean p.o. D.P	One month mean p.o. D.P	Two months mean p.o. D.P
Mean power± SD	38.16±1.34	40.83±1.80*	39.83±1.97*	38.83±0.49*

**** significant*** ***D.P: diopteric power*** ***P.O: postoperative***

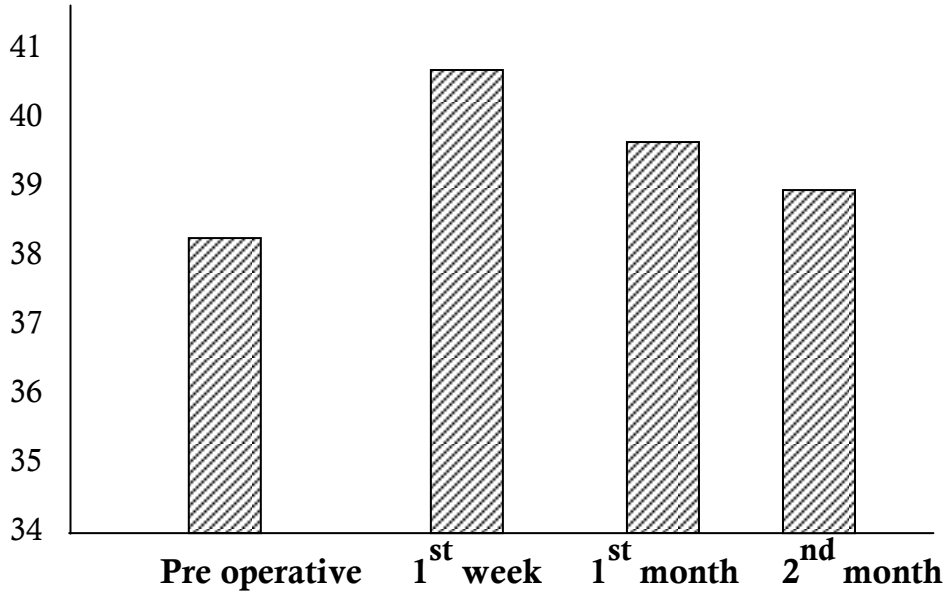

Fig (24) the mean diopteric power changes in the peripheral area opposite lateral rectus muscle in group(A_1).

In group (A_2):-

As regards topographic changes in the steep and flat meridians and sim K.

All eyes in this group showed at the end of follow up period vertical steeping and with the rule astigmatism in an axis ranging between 60 and 120 .

At that time patients showed a non significant difference (P > 0.05) in the mean diopteric power of astigmatism, both in the steep (44.15±0.65 D) and flat (40.33±0.83D) meridians compared to the preoperative mean power measures in both steep and flat meridians (43.6±1.35D and 40 ±2.2 D) respectively. Despite the significant (P < 0.05) difference of the mean power of steep meridian recorded at one week postoperatively (45.25±1.97 D) compared to preoperative measures ***(table 8 ,fig 25)***.

The sim k at two months (3.82±2.67D) showed non significant difference (P>0.05) compared to preoperative measure (3.6±0. 83D) ***(table 8 ,fig 26)***.

Table (8) the mean diopteric power changes of the steep and flat meridians and Sim K astigmatism in the group(A2)

Type of astigmatism	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o. D.P	Two months mean p.o D.P
Mean diopteric power of steep meridian	43.67±1.35	45.25±1.97 *	44.65± 3.12	44.15± 0.65
Mean diopteric power of flat meridian	40.06±2.20	40.92± 2.60	40.70 ±1.70	40.33±0.83
Mean sim k	3.61±0.87	4.33±1.87	3.95±1. 97	3.82±2.67

**** significant*** ***D.P: diopteric power*** ***P.O: postoperative***

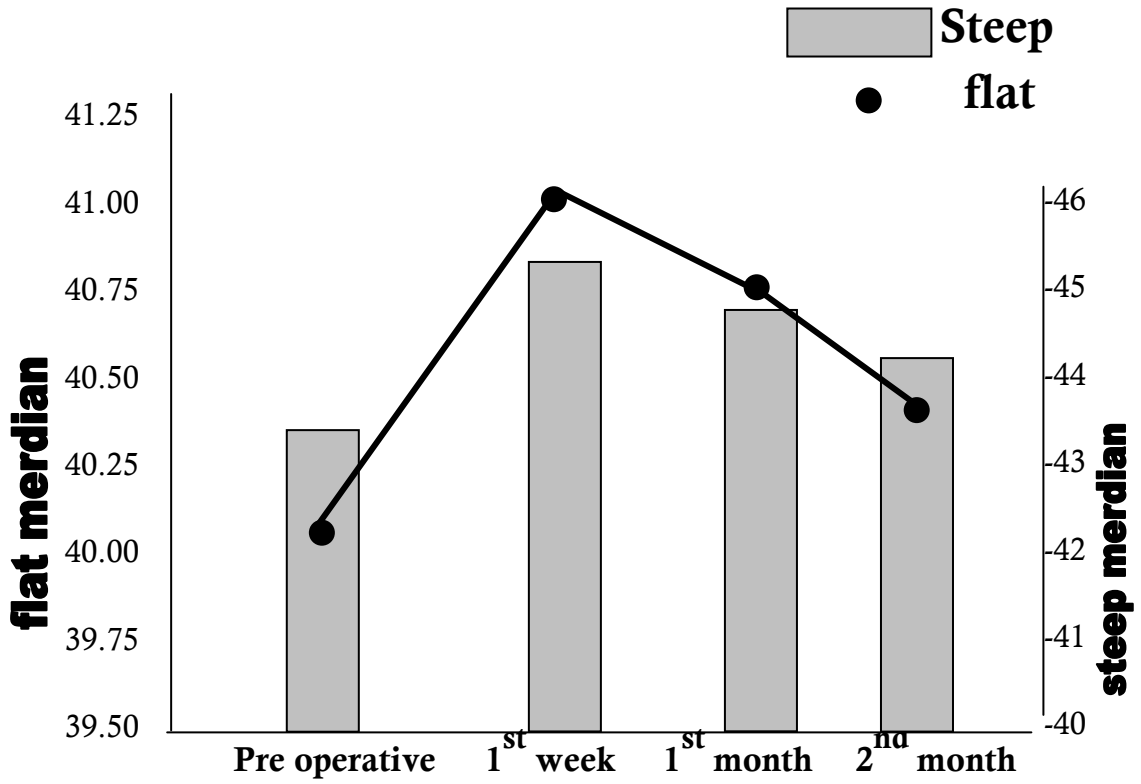

Fig (25) changes in diopteric power of the steep and flat meridians in group (A2) .

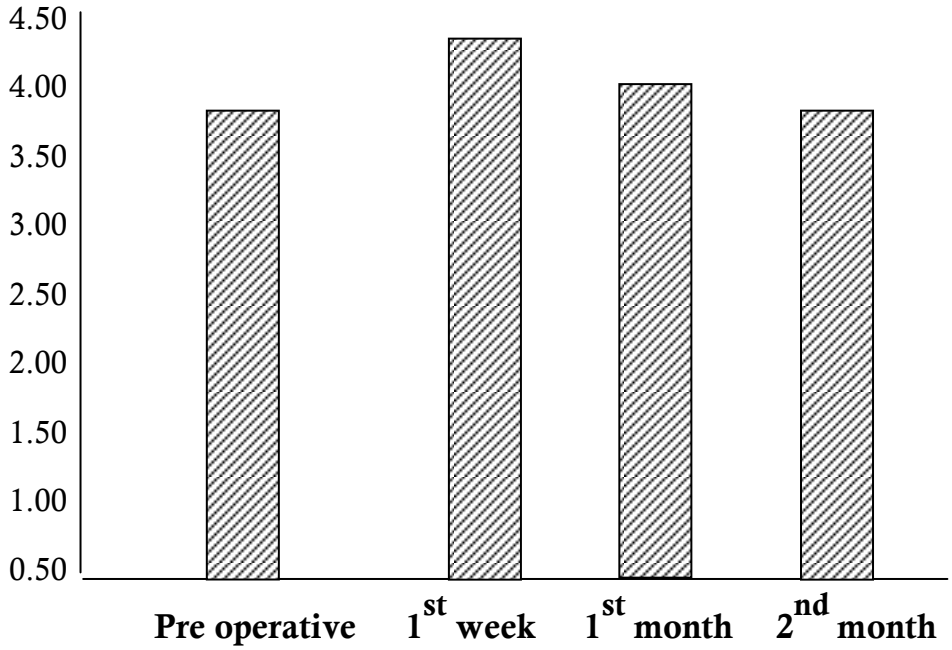

Fig. (26) the changes in mean sim K astigmatism in group (A2)

As regard the topographic changes of the central 3 mm zone:

The mean preoperative diopteric power was 40.93±2.54D increased to 43.40 ±3.11D one week postoperatively and reduced to 42.66±2.67D and 41.33 +1.60 D at one and two months postoperatively respectively.

These changes were statistically significant at one week postoperatively ($p<0.05$) while others were not ($P>0.05$).

(table 9) (fig27).

Table (9): the mean diopteric power changes in central 3 mm zone in group (A2)

	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o D.P	Two months mean p.o. D.P
Mean Power±S D	40.93 ± 2.54	43.40± 3.11 *	42.66 ± 2.67	41.33± 1.60

** significant D.P: diopteric power P.O: postoperative*

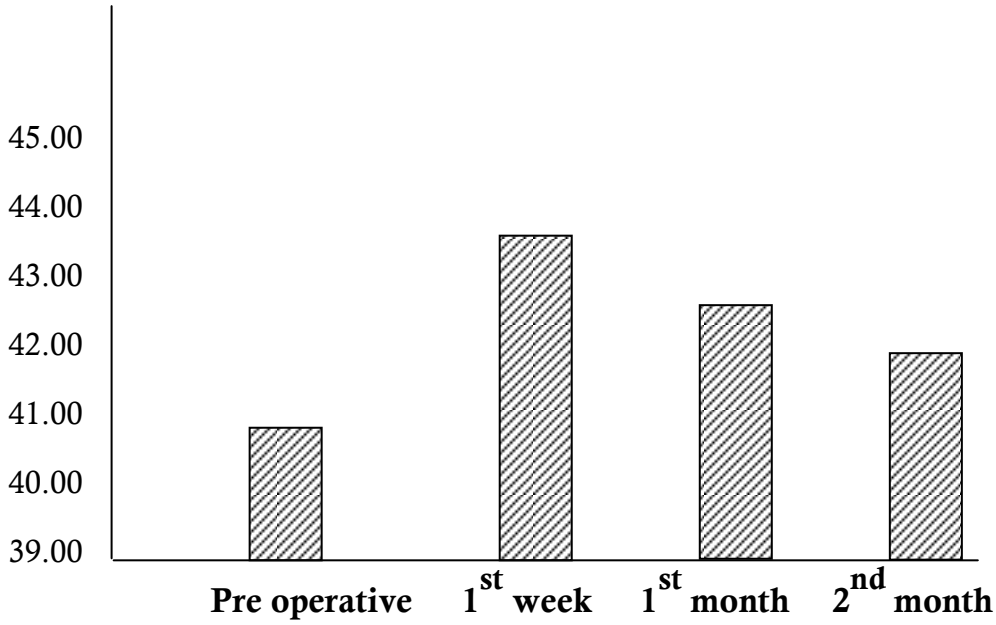

Fig. (27): the mean diopteric power changes in central 3mm zone in group (A2)

As regard the topographic changes in the peripheral area opposite the recti muscles :

The mean preoperative power in the peripheral area opposite the medial rectus muscle was 39.16±2.30D increased to 41.16 ±1.56 D one week postoperatively and reduced to 40.50 ±1.49D and 39.39 ±1.62D at one and two months postoperatively respectively.

The statistically significant changes were at one week postoperatively (P< 0.05) while others were not (P>0.05)***(table 10) (fig28).***

The mean preoperative diopteric power in the peripheral area opposite the lateral retcus muscle was 36.66 ± 1.56D reduced to 34.83±2.21 D one week postoperatively and increased to 36.00±1.60Dand 36.33 ± 0.87 D at one and two months postoperatively respectively.

The statistically significant changes were at one week postoperatively (P< 0.05) while others were not (P>0.05)
(table 11) (fig29).

Table (10) the diopteric power changes in the peripheral area opposite the medial rectus muscle in group(A 2)

	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o. D.P	Two months mean p.o D.P
Mean power±S D	39.16± 2.30	41.16±1.56 *	40.50 ±1.49	39.39 ±1.62

** Significant D.P: diopteric power P.O: postoperative*

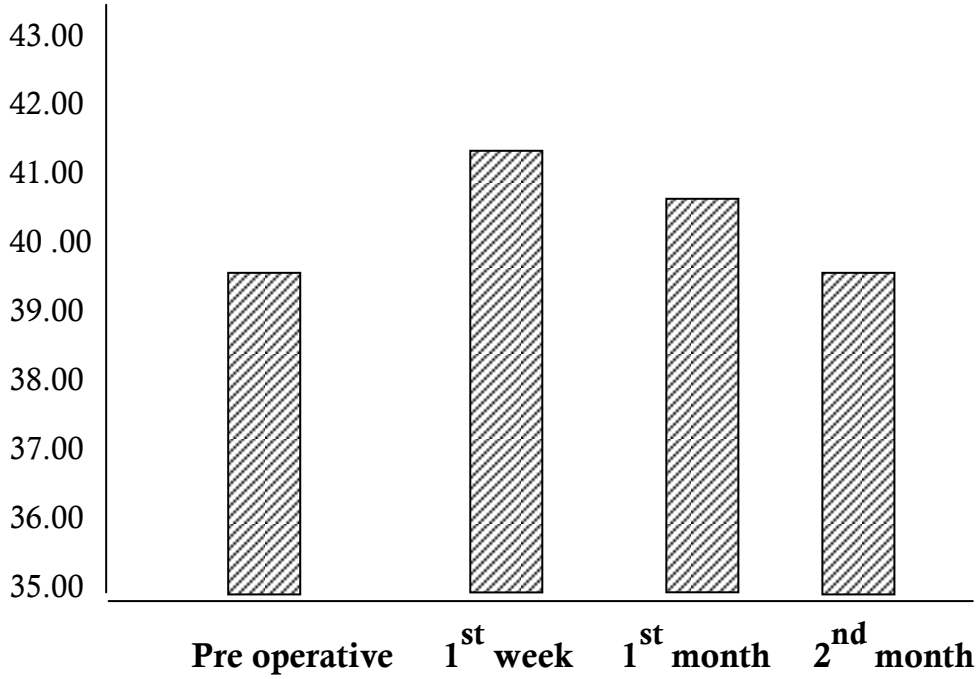

Fig. (28) the mean diopteric power changes in the peripheral area opposite medial rectus muscle in group(A2).

Table (11) the mean diopteric power changes in the peripheral area opposite lateral rectus muscle in group (A2)

	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o D.P	Two months mean p.o D.P
Mean power± SD	36.66±1.56	34.83±2.21*	36.00±1.60	36.33±0.87

**** significant*** ***D.P: diopteric power*** ***P.O: postoperative***

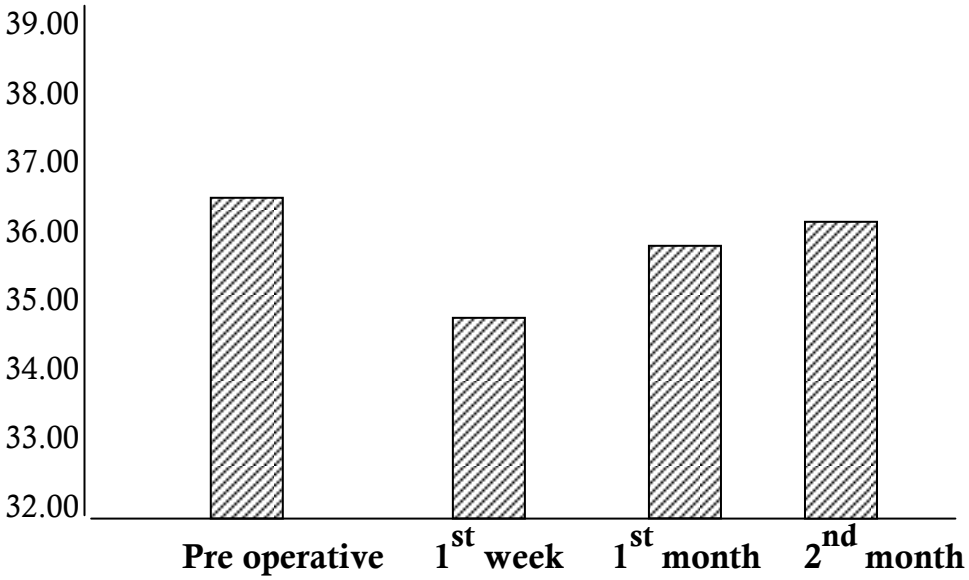

Fig. (29) the mean diopteric power changes in the peripheral area opposite lateral rectus muscle in group(A2).

In group (B):-

At the end of follow up period, all cases of this group showed vertical steeping and with the rule astigmatism with an axis ranging between 70 and 110.

Patients included in this group showed progression of astigmatism through the first week to the first month but returned to near the preoperative level at two months postoperatively.

Patients showed a non significant difference (P>0.05) in the mean power of astigmatism both in the steep, (41.8±1.3 D) and flat (39.5±1.8D) meridians at two months compared to preoperative measures in both meridians (41+1.6 and 39+1.7 D) respectively ***(table 12 , fig. 30).***

The sim K of this group at one month postoperatively was (2.8+0.57) showed statistically significant increase (P<0.05) in comparison to preoperative measure (2.17+0.87). ***(table 12, fig.31).***

Table (12) the mean diopteric power changes of the steep and flat meridians and Sim K astigmatism in the group(B)

Type of astigmatism	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o D.P	Two months mean p.o D.P
Mean diopteric power of steep meridians.	41.00± 1.64	* 45.08±1.15	42.59±1.70	41.80±1.30
Mean diopteric power of flat meridians	39.00±1.72	* 42.55±1.15	39.79±2.16	39.50±1.80
Mean sim K	2.17±0.87	2.53± 0.85	* 2.80±0.57	2.70±0.85

**** significant*** ***D.P: diopteric power*** ***P.O: postoperative***

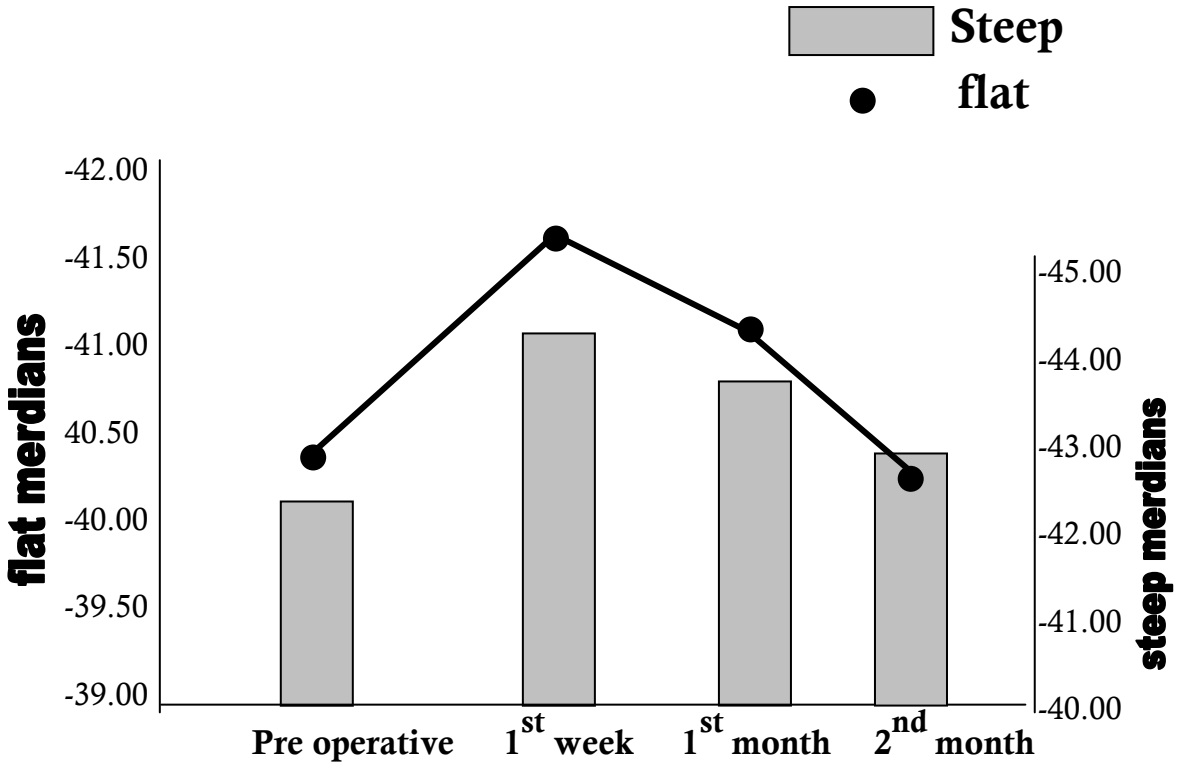

Fig. (30) changes in mean diopteric power of the steep and flat meridians in group (B) .

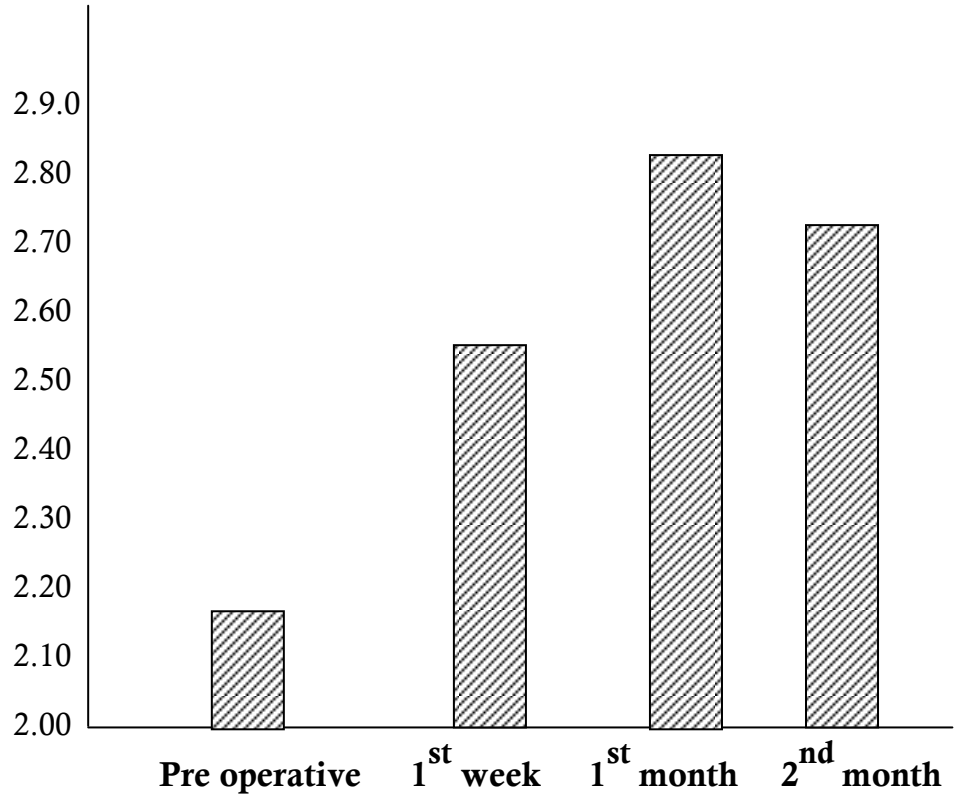

Fig. (31) the changes in mean sim K astigmatism in group (B)

As regard the topographic changes in central 3 mm. zone:

The mean preoperative diopteric power was 40.96± 1.44 D ±1.03 D increased to 44.06±1.03 D one week postoperatively and reduced to 42.73±1.16 D and 41.54 ±1.22 D one and two months postoperatively respectively. The only significant changes were after one week (P<0.05) while others were not (p > 0.05) ***(table13)*** ***(fig 32).***

Table(13) the mean diopteric power changes in the central 3mm zone in group B:

	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o D.P	Two months mean p.o D.P
Mean power ± SD	40.96 ± 1.44	44.06 * ± 1.03	42.73 ± 1.16	41.56 ± 1.22

** significant D.P: diopteric power P.O: postoperative*

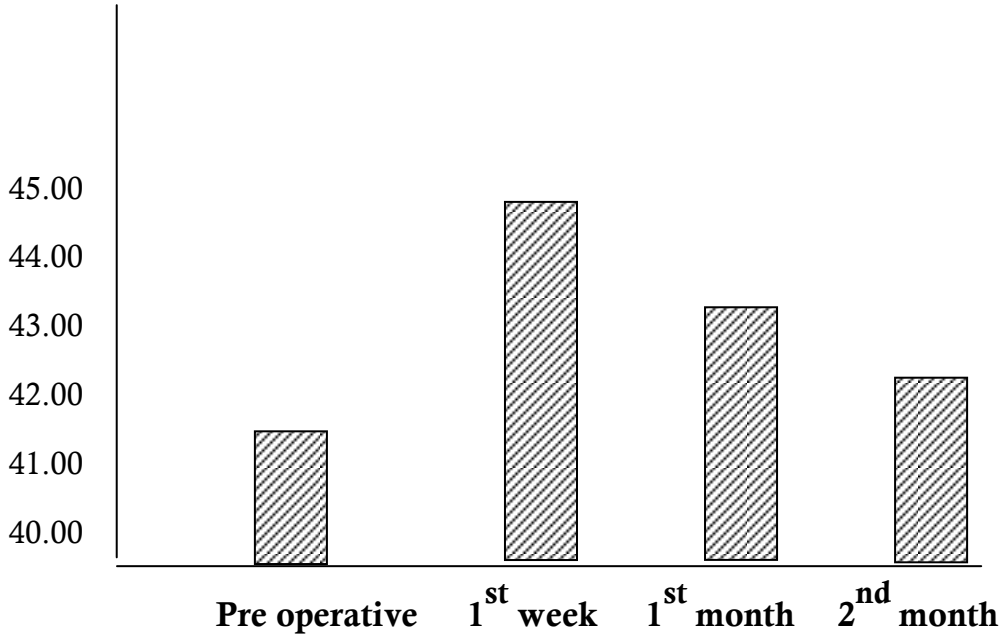

Fig .(32) the mean diopteric power changes in the central 3mm zone in group B

As regard the topographic changes in the peripheral area opposite recti muscles :

The mean preoperative diopteric power in the peripheral area opposite the medial rectus muscle was 38.00 ±2.75 D reduced to 34.50 ± 3.09 D one week postoperatively increased to 34.66 ± 3.23 D and 35.00 ± 3.0 95 D at one and two months postoperatively .

These change were statistically significant at one week postoperatively (P <0.05) while others were not (P>0.05)

(***table 14) (fig 33).***

The mean preoperative diopteric power in the peripheral area opposite lateral rectus muscle was 36.16 ± 2.97 increased to 39.33 ± 2.46 D one week postoperatively, reduced to 39.16 ±2:25D and 39.00 ± 2.23 D one and two months postoperatively respectively.

The changes at one week and one month postoperatively were statistically significant (p<0.05) ***(table 15) (fig .34).***

Table(14) the mean diopteric power changes in peripheral area opposite medial rectus muscle in group (B)

	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o D.P	Two months mean p.o D.P
Mean power ±S D	38.00±27S D	34.500±3.09*	34.66 ±3.23	35.00±3.09

** significant* *D.P: diopteric power* *P.O: postoperative*

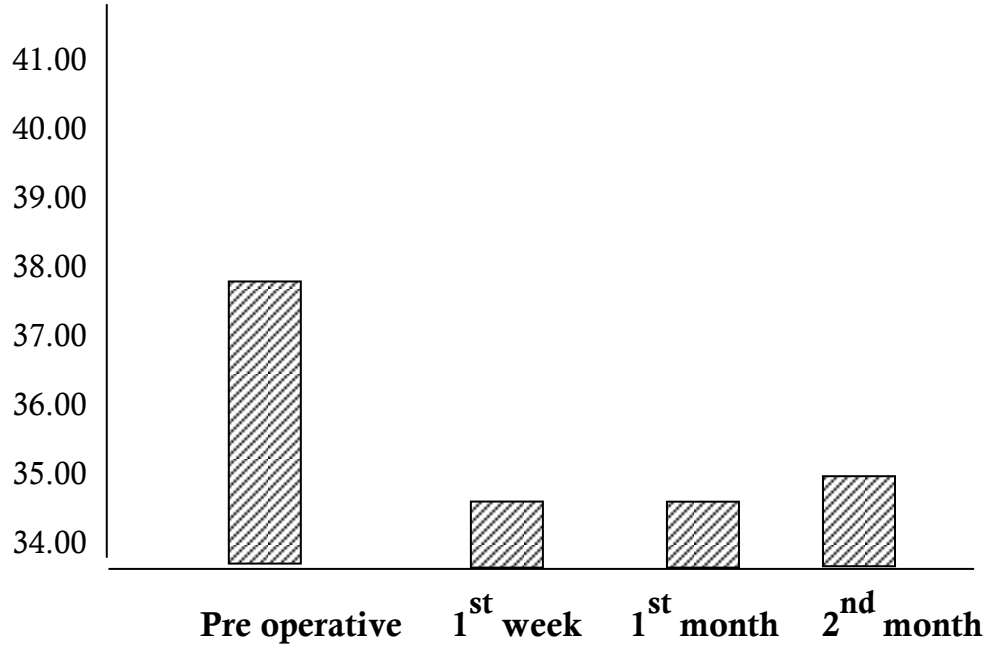

Fig. (33) the mean diopteric power changes in the peripheral area opposite the medial rectus muscle

Table (15) the mean diopteric power changes in peripheral area opposite lateral rectus muscle in group (B):

	Mean Preoperative D.P	One week mean p.o D.P	One month mean p.o D.P	Two months mean p.o D.P
Mean power ± S D	36.16 ± 2.96	39.33 ± 2.46 *	39.16 ± 2.25 *	39.00 ±2.23

**** significant*** ***D.P: diopteric power*** ***P.O: postoperative***

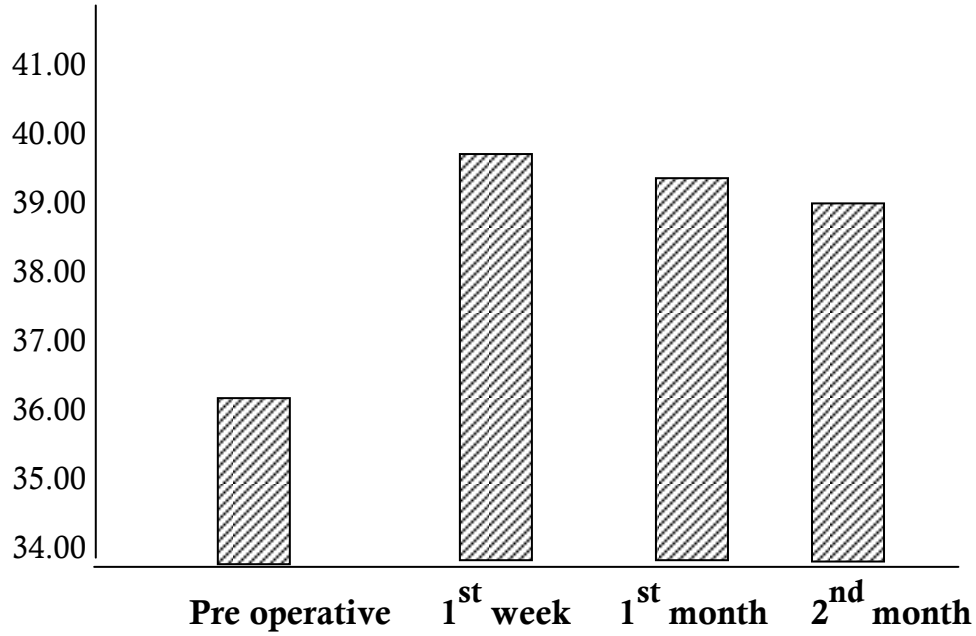

Fig. (34) the mean diopteric power changes in the peripheral area opposite lateral rectus muscle in group (B)

In group (C):-

As regards topographic changes in the steep and flat meridians and sim K measured by orbscan:

There were two cases only. They showed vertical flattening and against the rule astigmatism with an axes of 50 and 160.

The cases showed reduction in the power of astigmatism both in steep and flat (40 and 36 D) meridians respectively at one week postoperatively compared to the preoperative levels in both meridians (43 and 39.8 D) **.**

The cases then showed progression of astigmatism at one month postoperatively in both steep (41.6 D) and flat (37.8 D) meridians and returned to near the preoperative levels in both meridians (42.3 and 38.9 D) respectively at two months postoperatively**.**

Moreover, sim K progressed to (3.6 D) and (3.8 D) one week and one month postoperatively as compared to the preoperative measure (3.2 D) and returned to near preoperative level (3.4 D) at the end of two months postoperatively ***(Fig.35).***

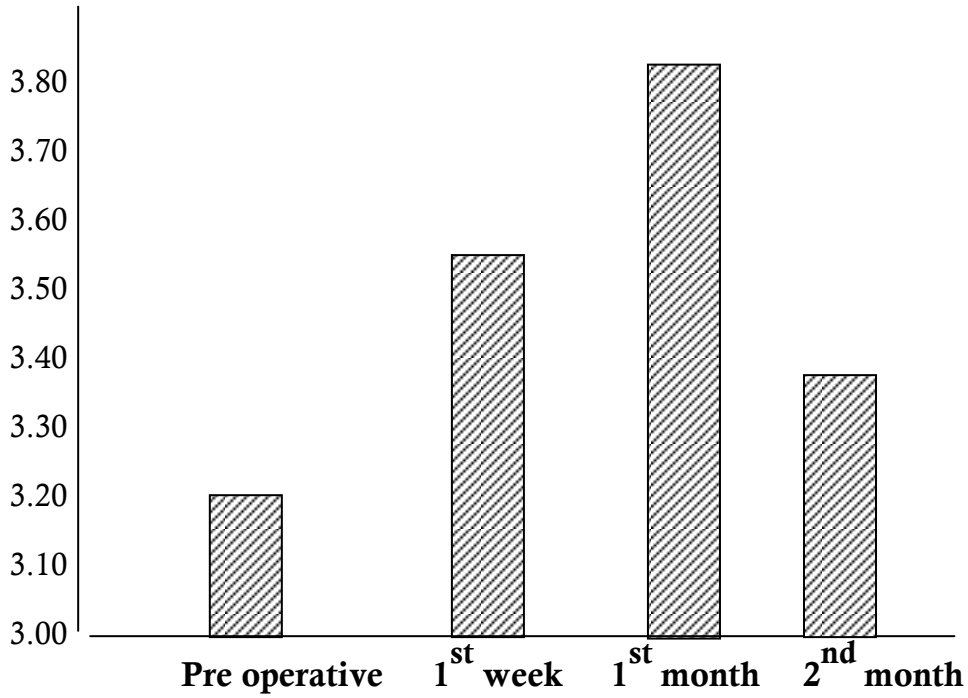

Fig. (35) the changes in the mean sim K astigmatism in group (C)

As regard the topographic changes in the central 3 mm zone:

The mean preoperative diopteric power was 42.80 D reduced to 40.20 D one week postoperatively and increased to 41.40D and 42.20 D one and two months postoperatively respectively ***(fig. 36).***

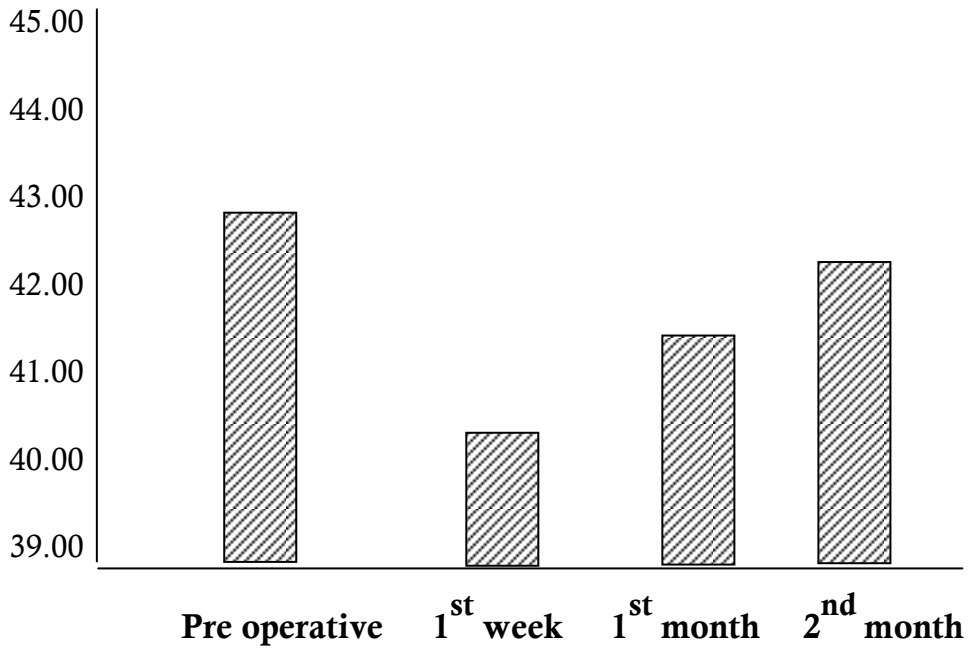

Fig. (36) the mean diopteric power changes in the central 3 mm zone in group (C)

As regard topographic changes in the peripheral area opposite recti muscle:

The mean preoperative diopteric power in the peripheral area opposite medial rectus muscle was 36.50 D reduced to 32.50 D one week and one month postoperatively respectively and increased to 32.70 D two months postoperatively ***(fig.37)***

While the mean preoperative diopteric power in the peripheral area opposite lateral rectus muscle was 35.50 D increased to 35.80D one week postoperatively and reduced to 35.70 D and 35.50D one and two months postoperatively respectively ***(fig.38)*** .

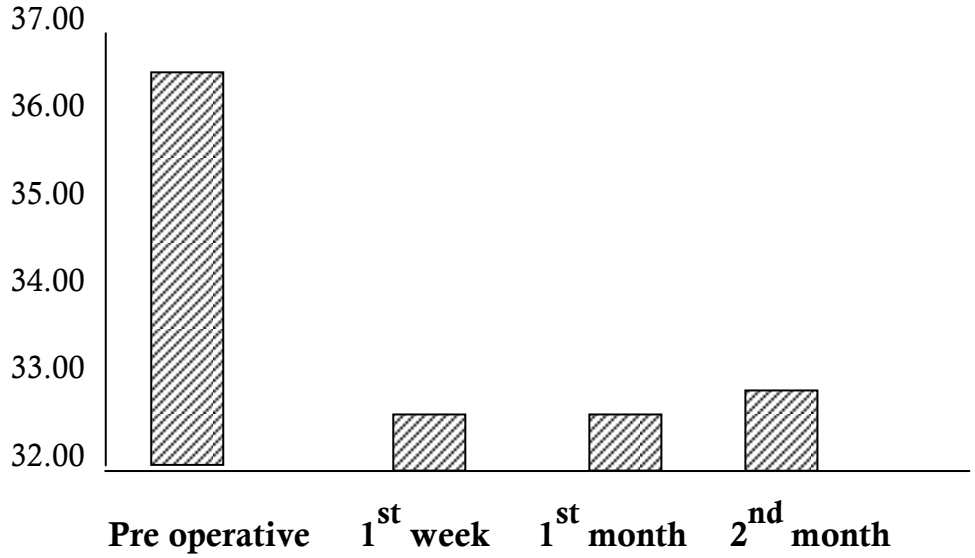

Fig. (37) the diopteric power changes in the peripheral area opposite medial rectus muscle

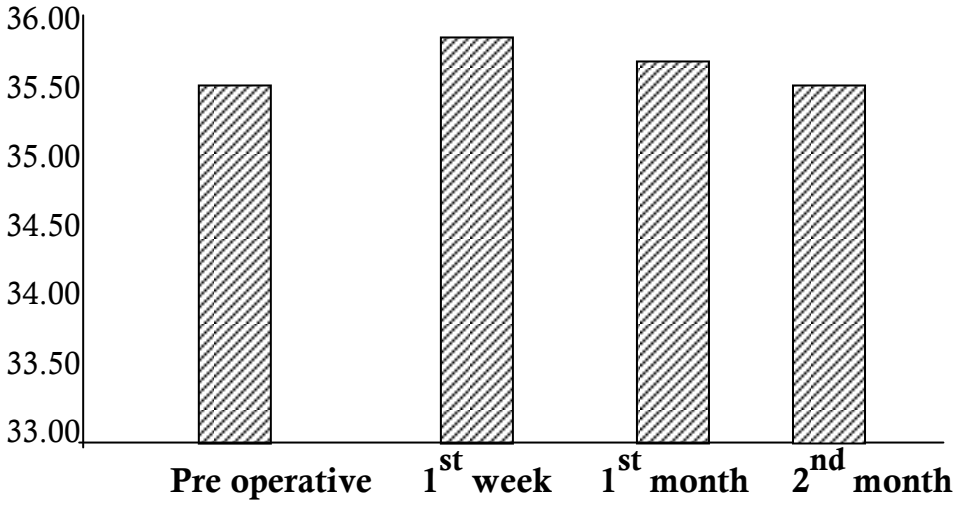

Fig. (38) the diopteric power changes in the peripheral area opposite lateral rectus muscle

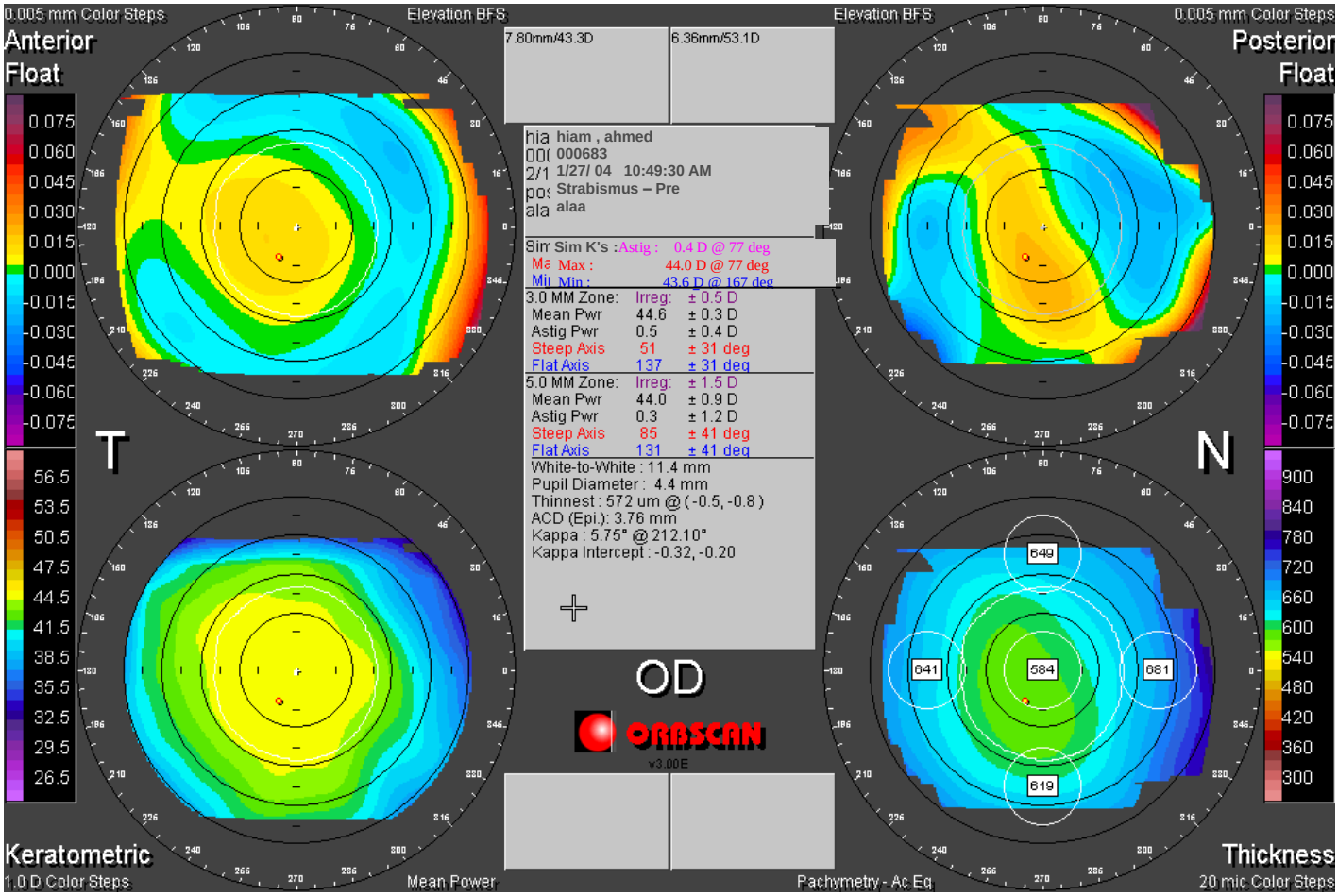

Fig. (39) : case (1) – group (A_1) :preoperative

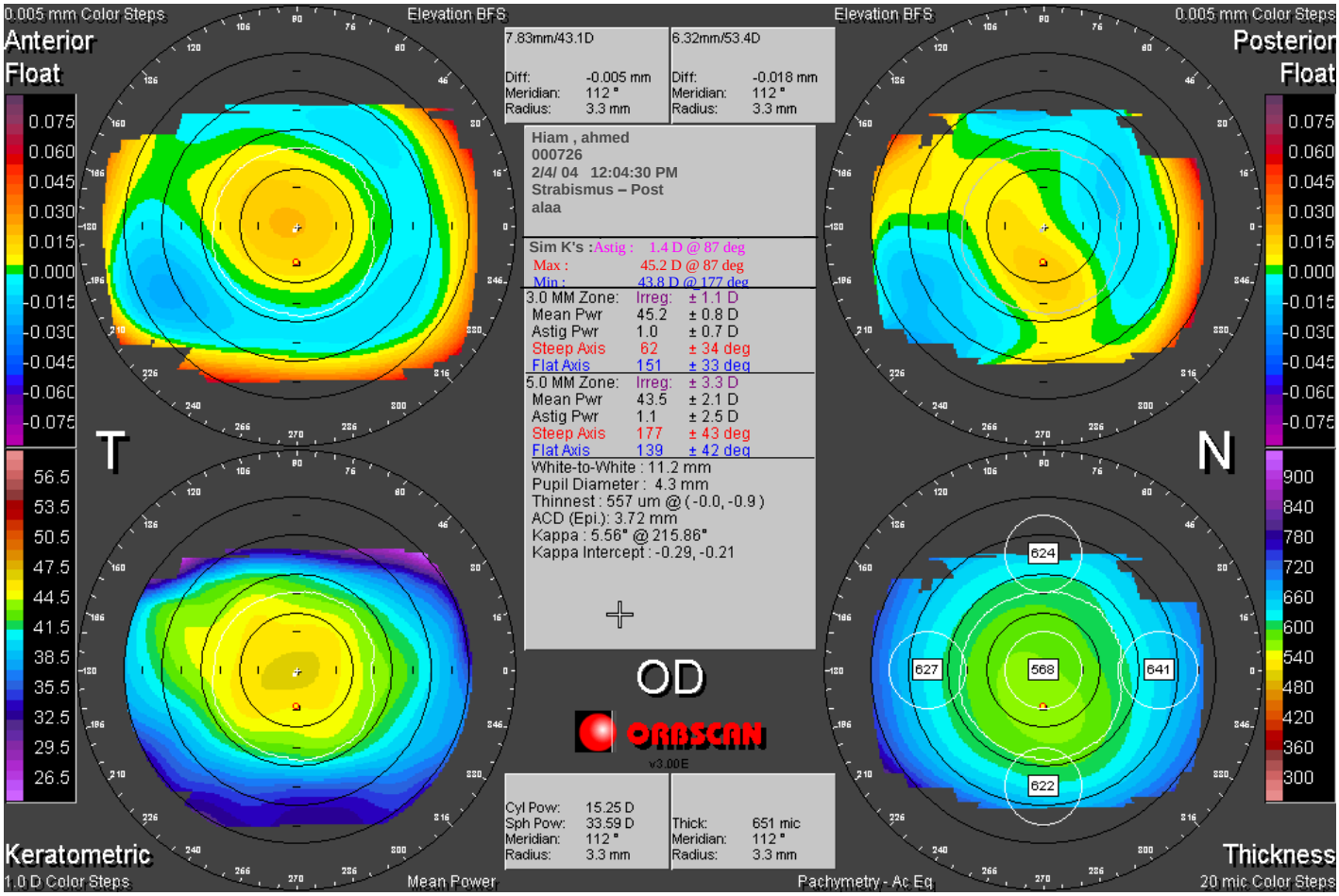

Fig. (40) : case (1) – group (A_1) : at one week postoperative

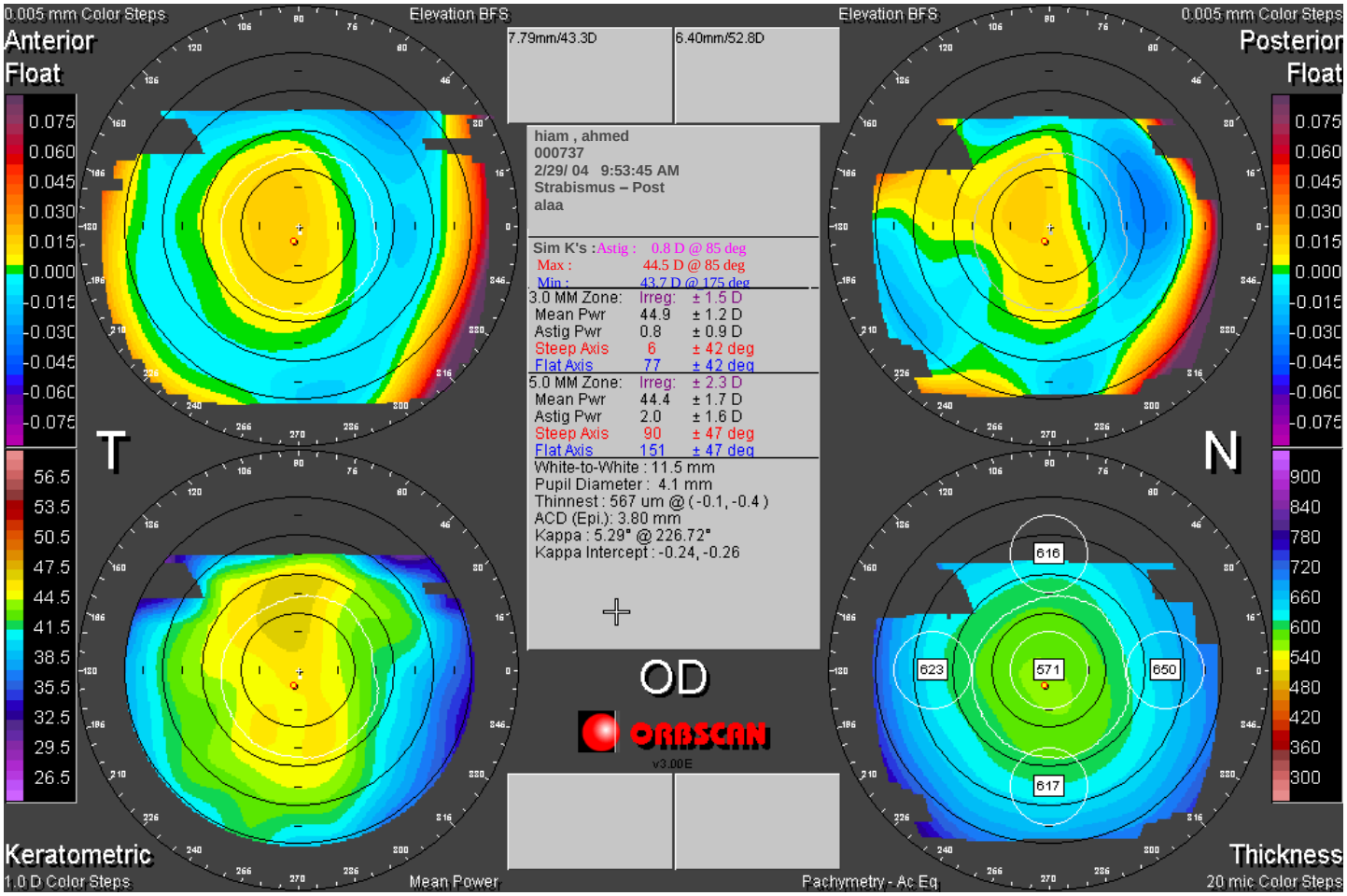

Fig . (41) : case (1) – group (A_1) : at one month postoperative

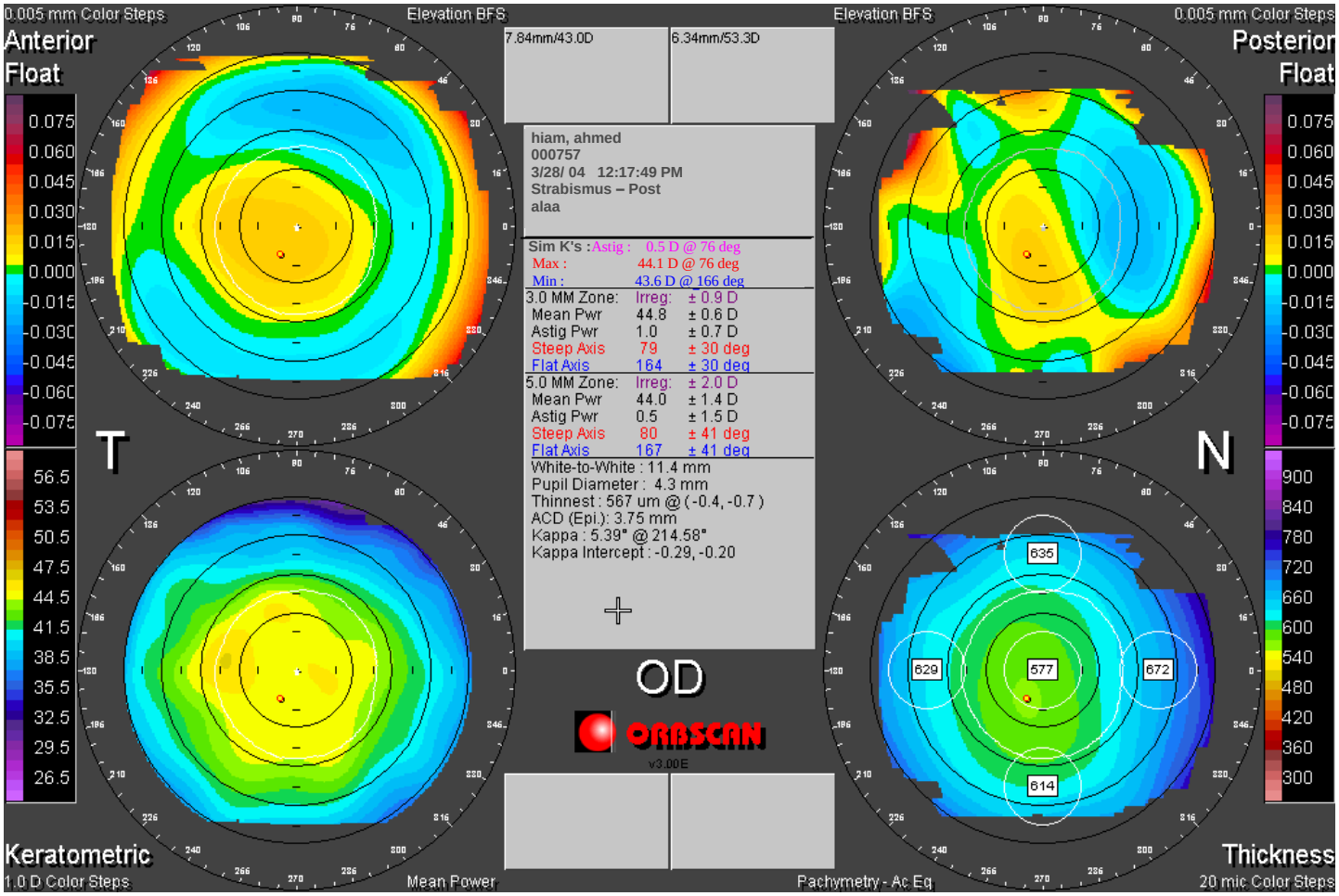

Fig . (42) : case (1) – group (A_1) : at two months postoperative

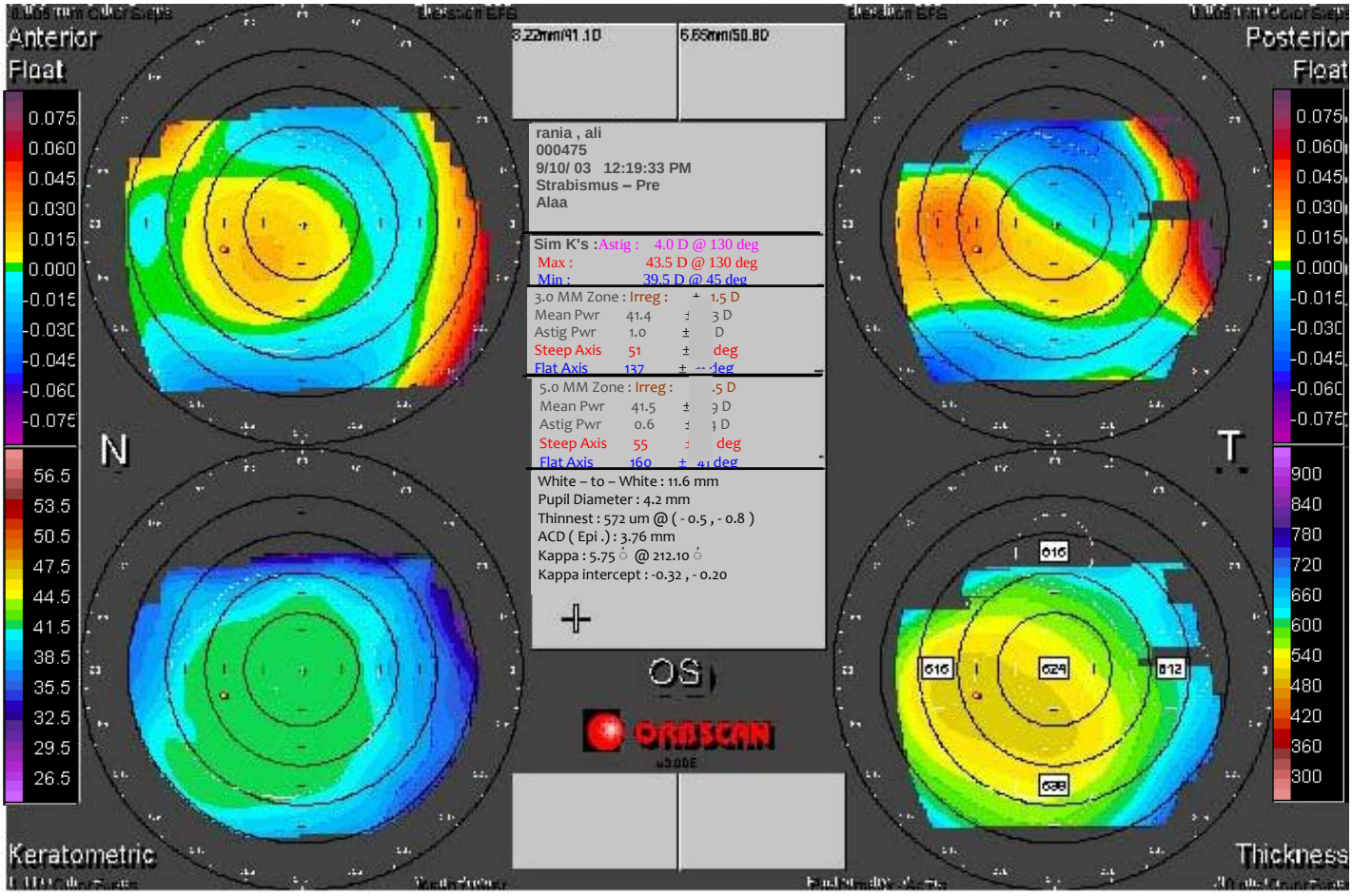

Fig . (٤٣):case (٢) – group (A٢) : preoperative

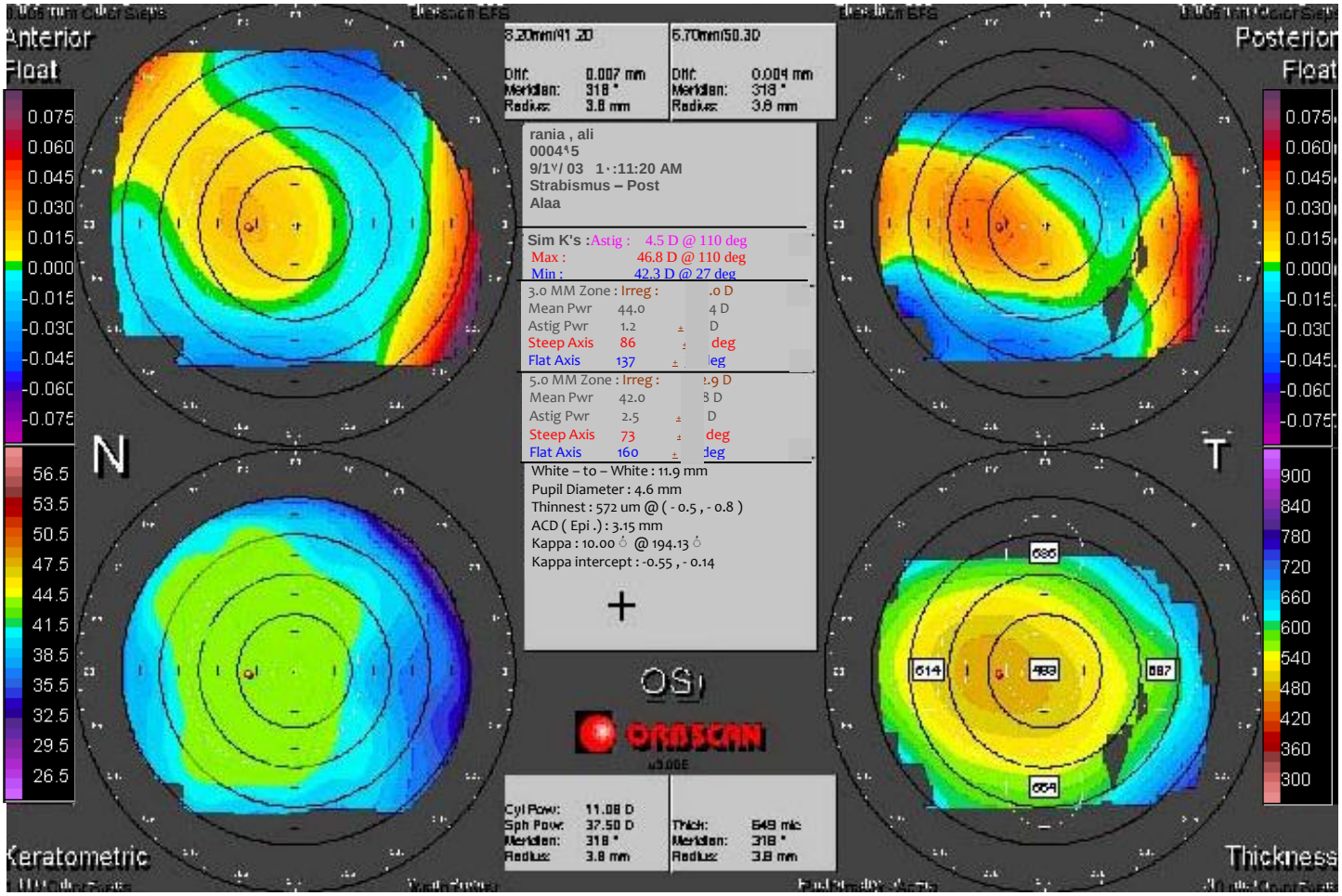

Fig . (٤٤):case (٢) – group (A٢) : at one week postoperative

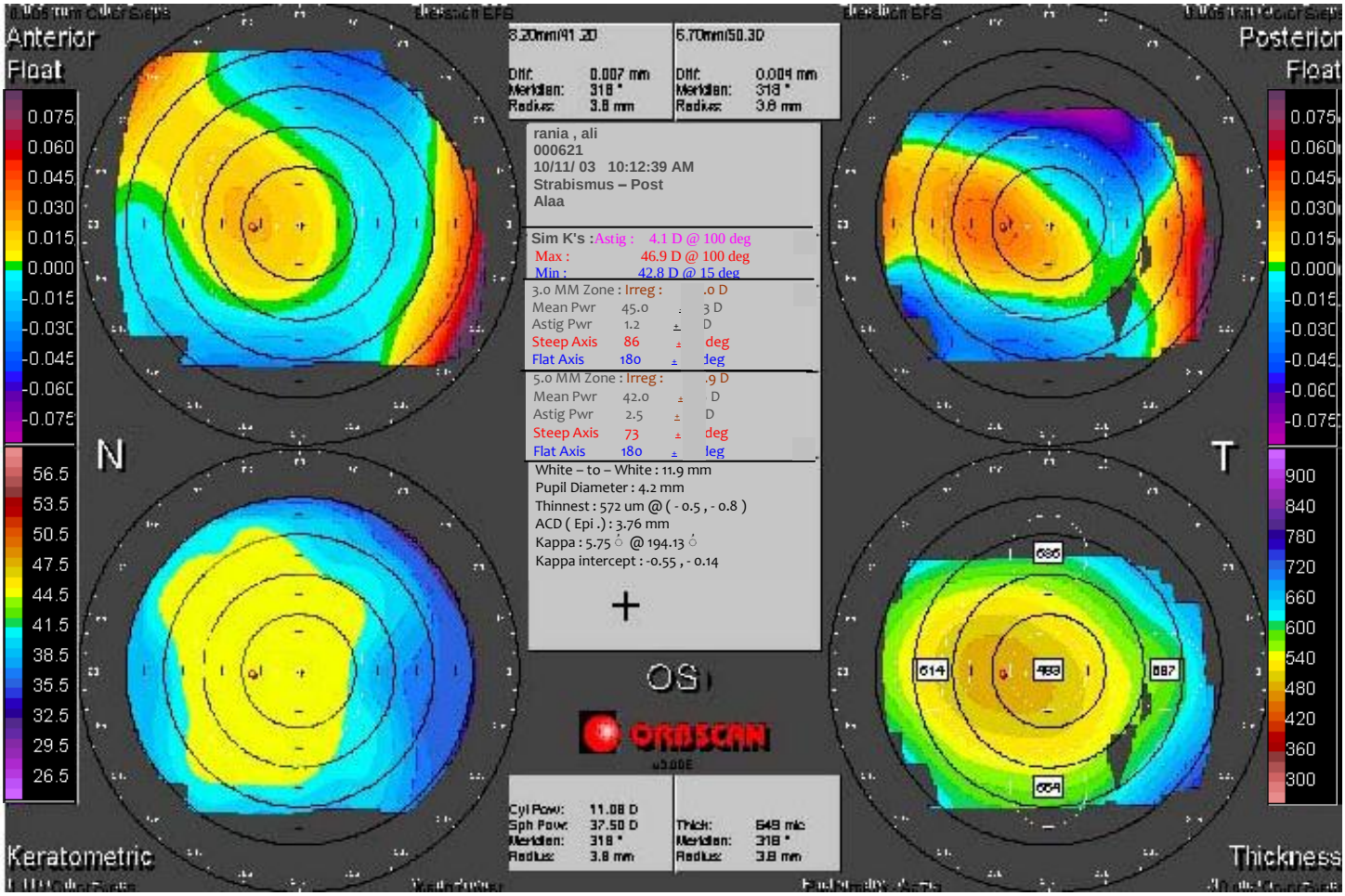

Fig . (٤٥):case (2) – group (A_1) : at one month postoperative

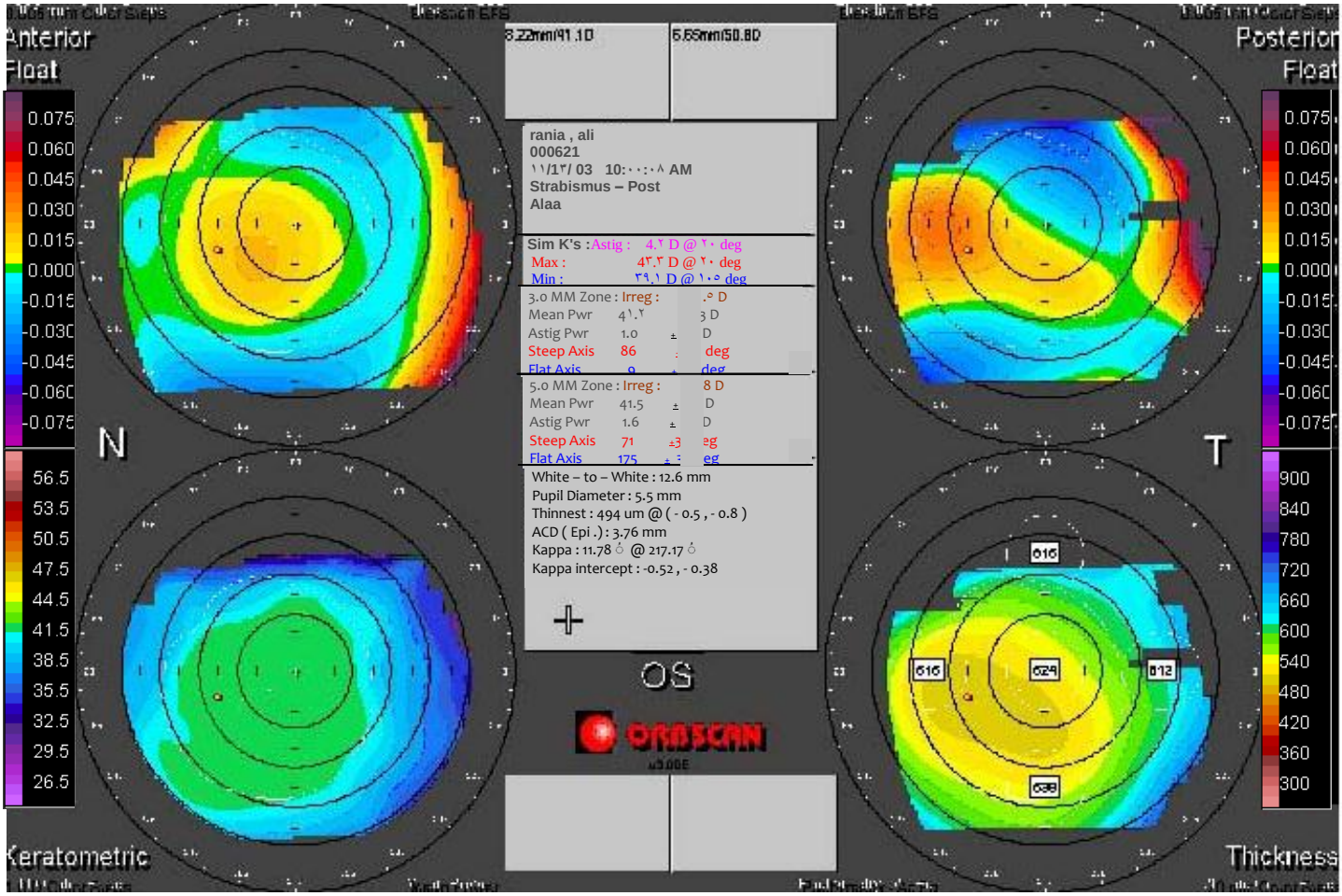

Fig . (٤٦):case (٢) – group (A_2) : at two months postoperative

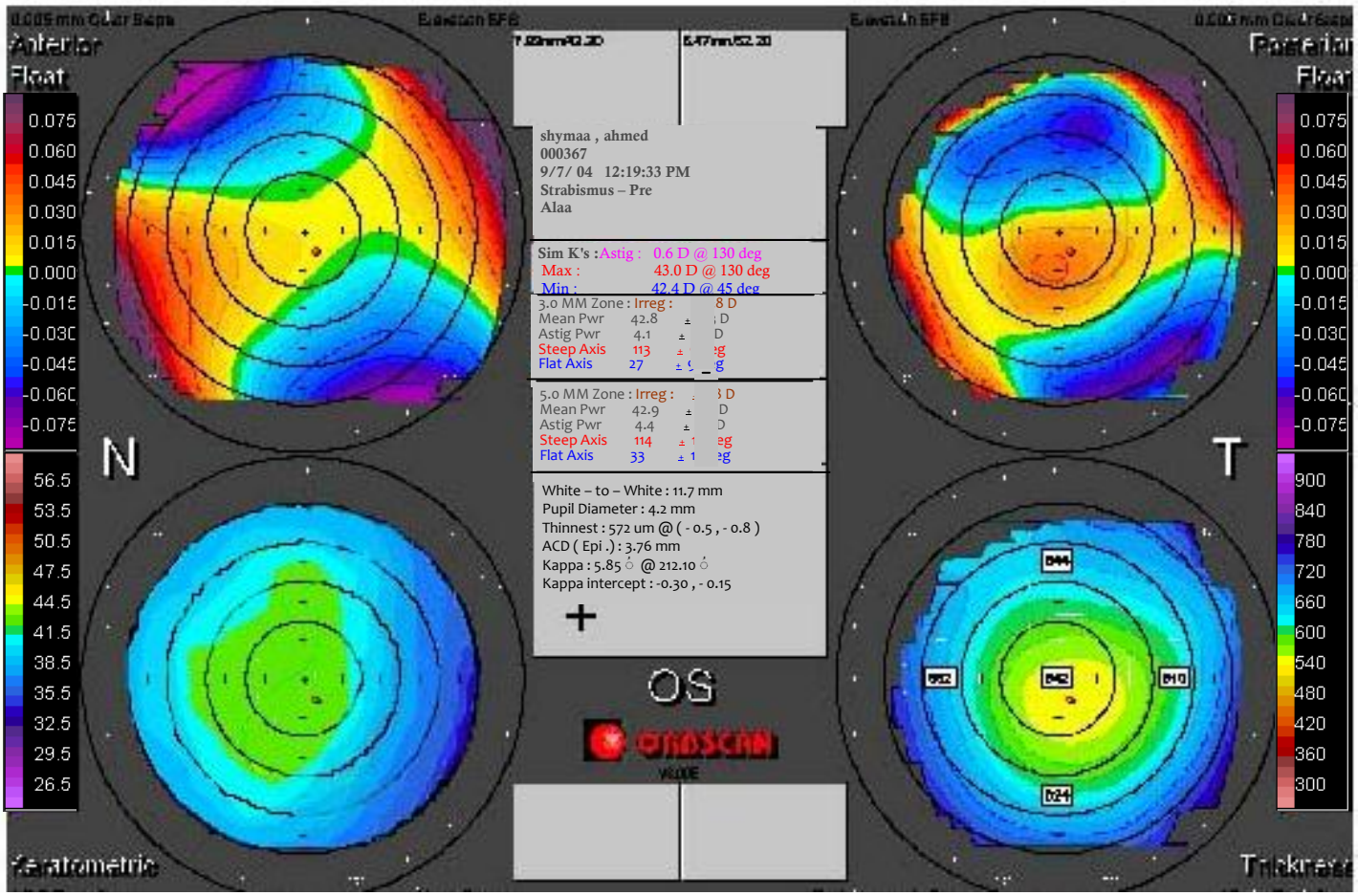

Fig. (47): case (3)- group(B) preoperative

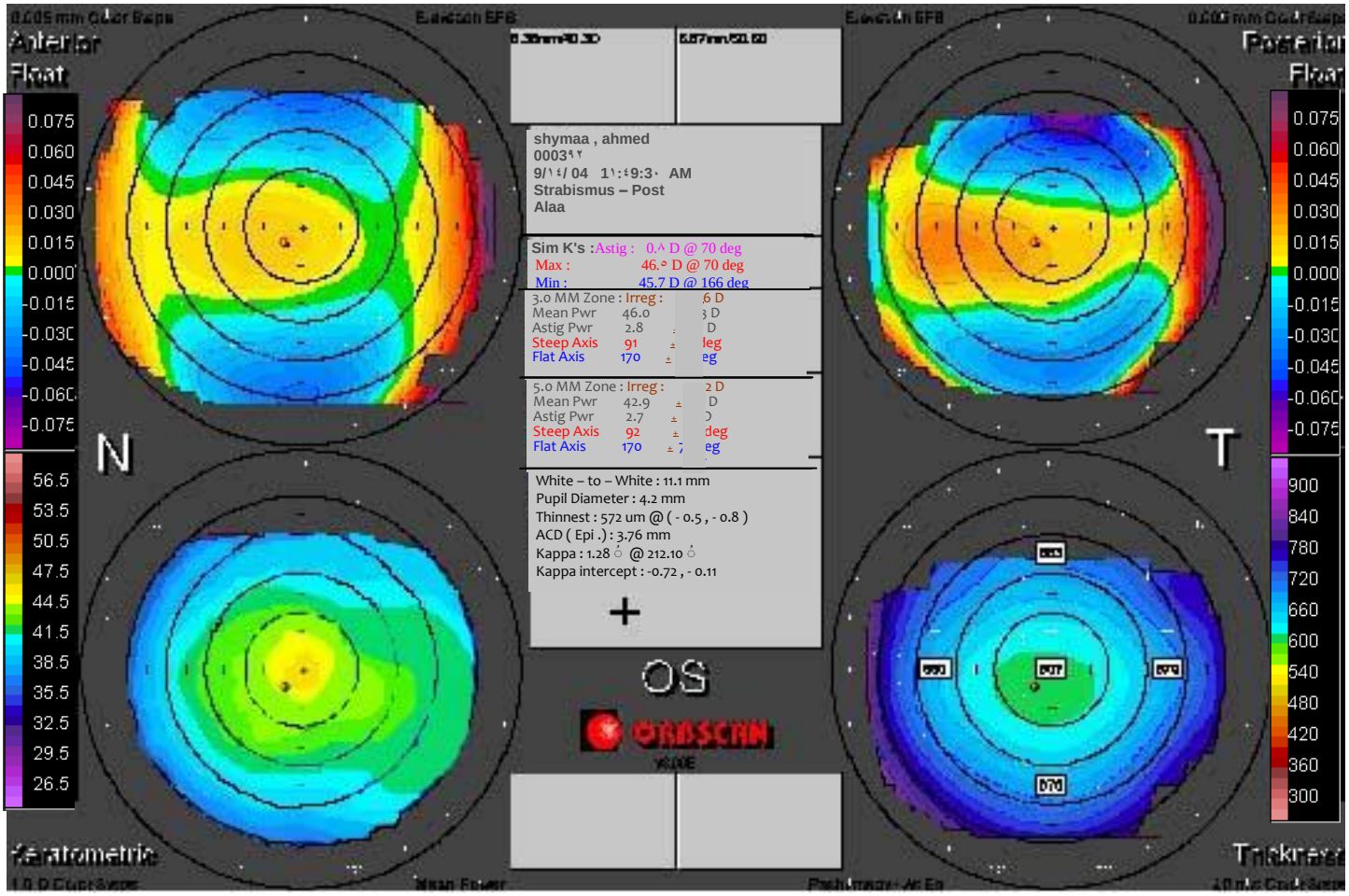

Fig. (48): case (3)- group(B): at one week postoperative

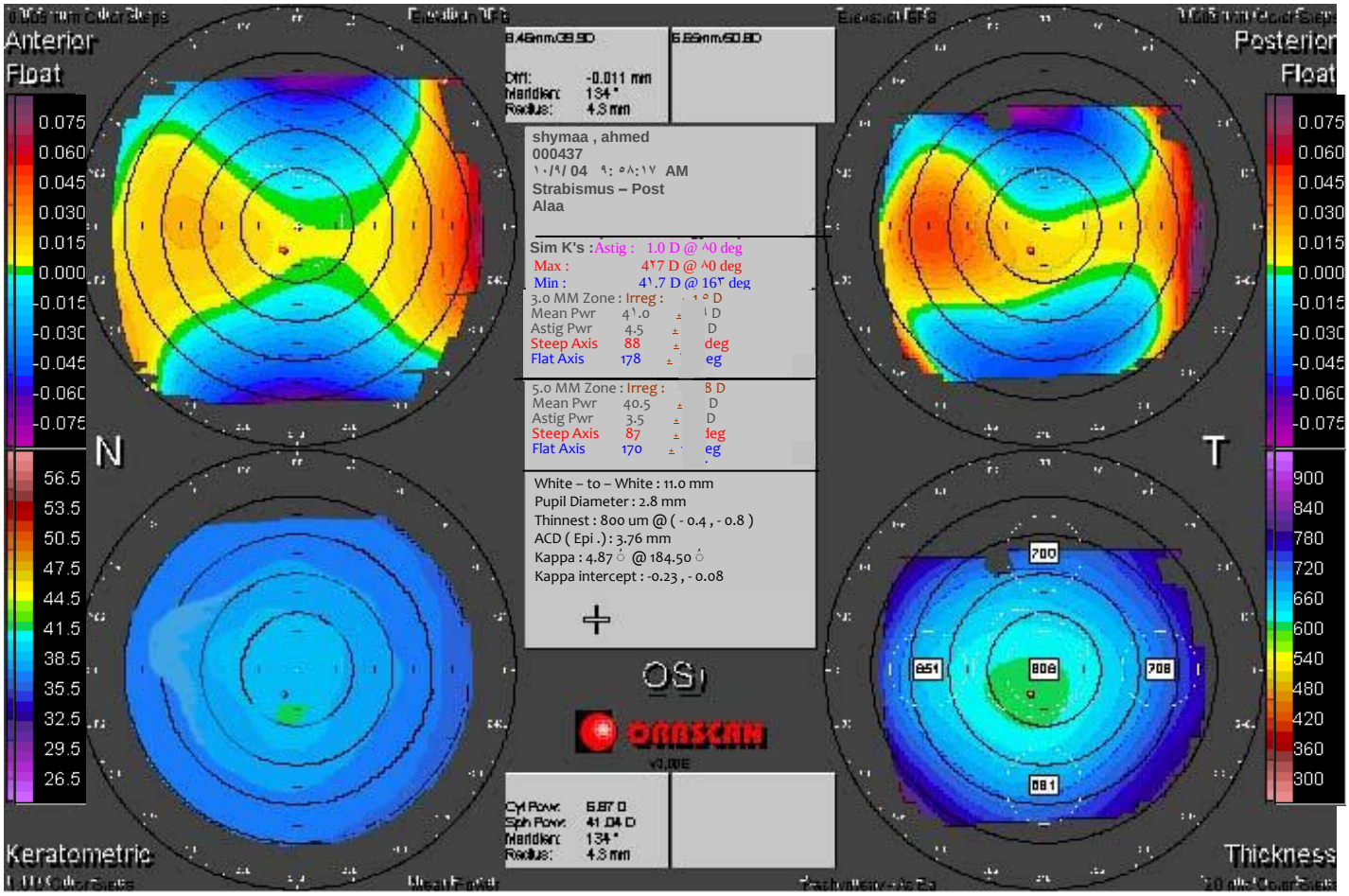

Fig. (49): case (3)- group(B): at one month postoperative

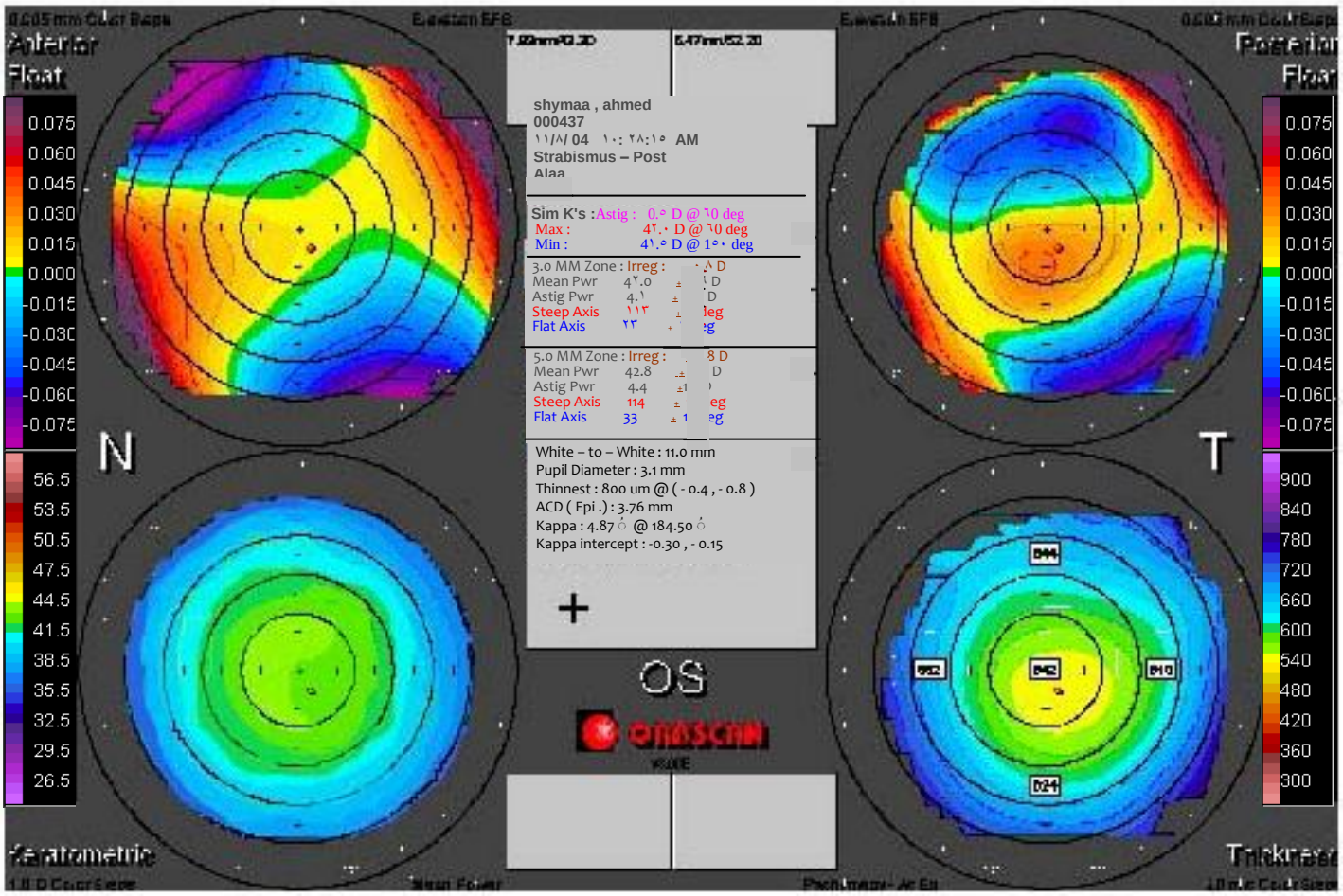

Fig. (50): case (3)- group(B): at two months postoperative

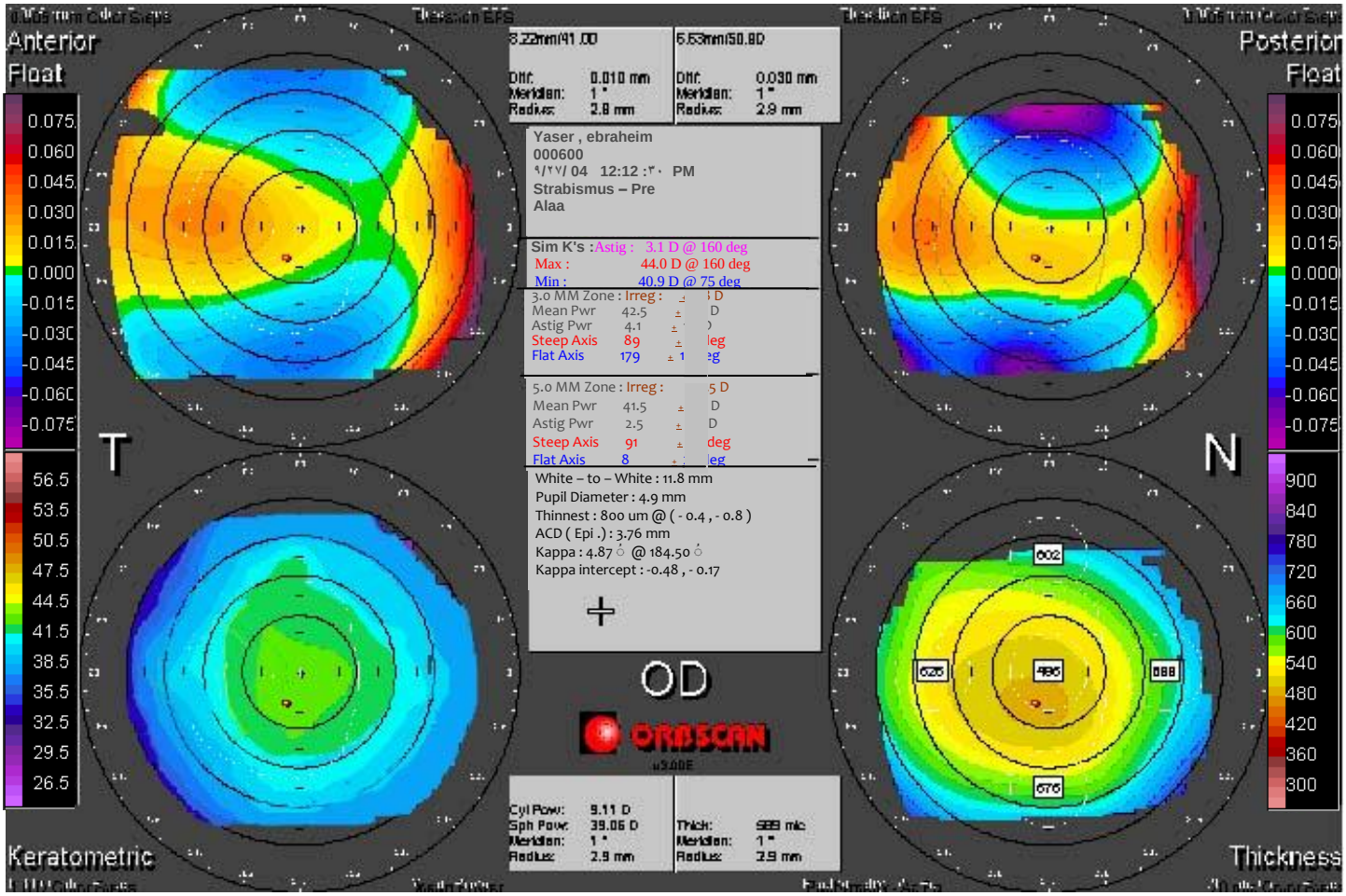

Fig. (51) : case(4) – group (C) preoperative

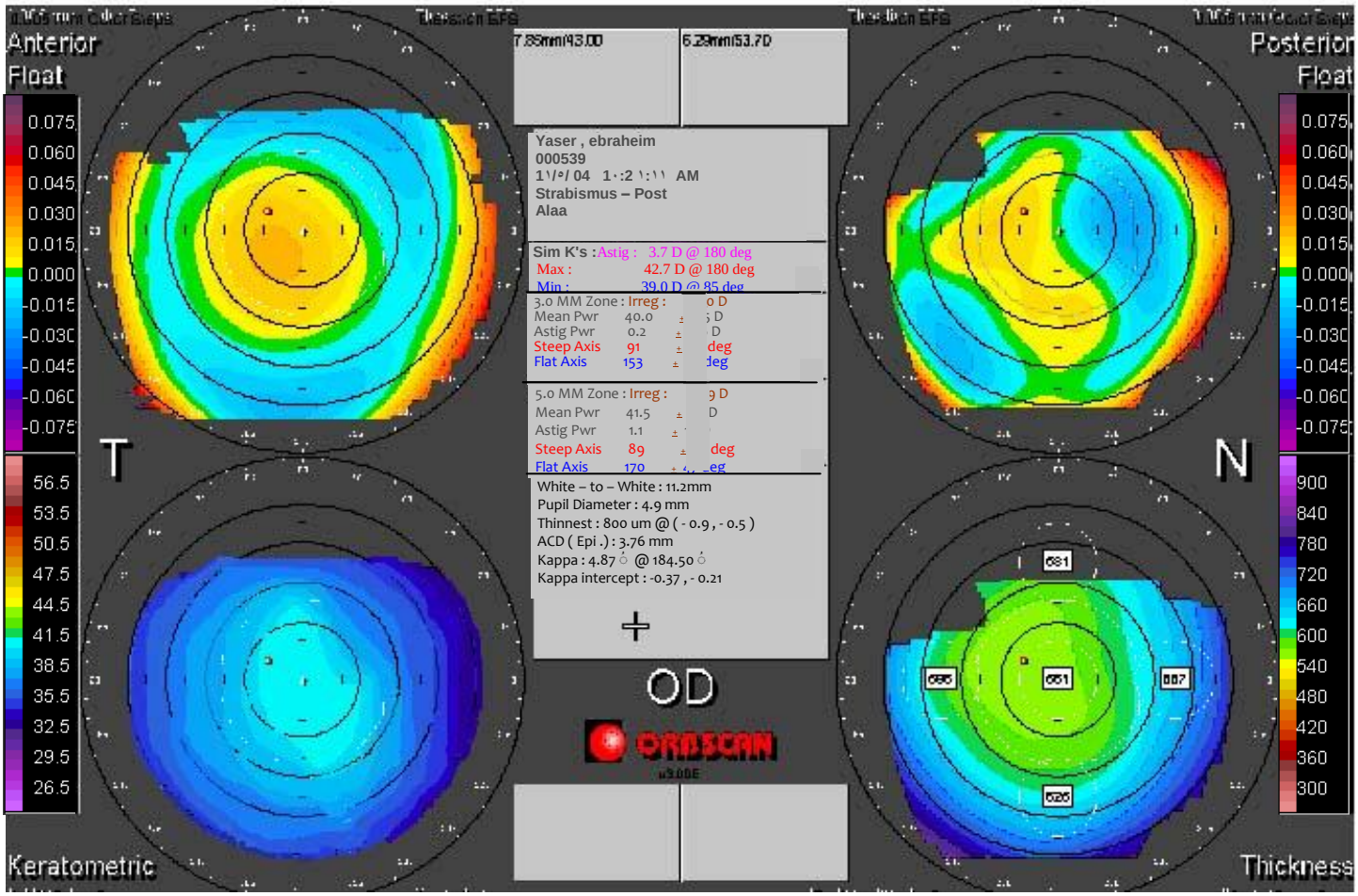

Fig. (52) : case (4) – group (C) : at one week postoperative

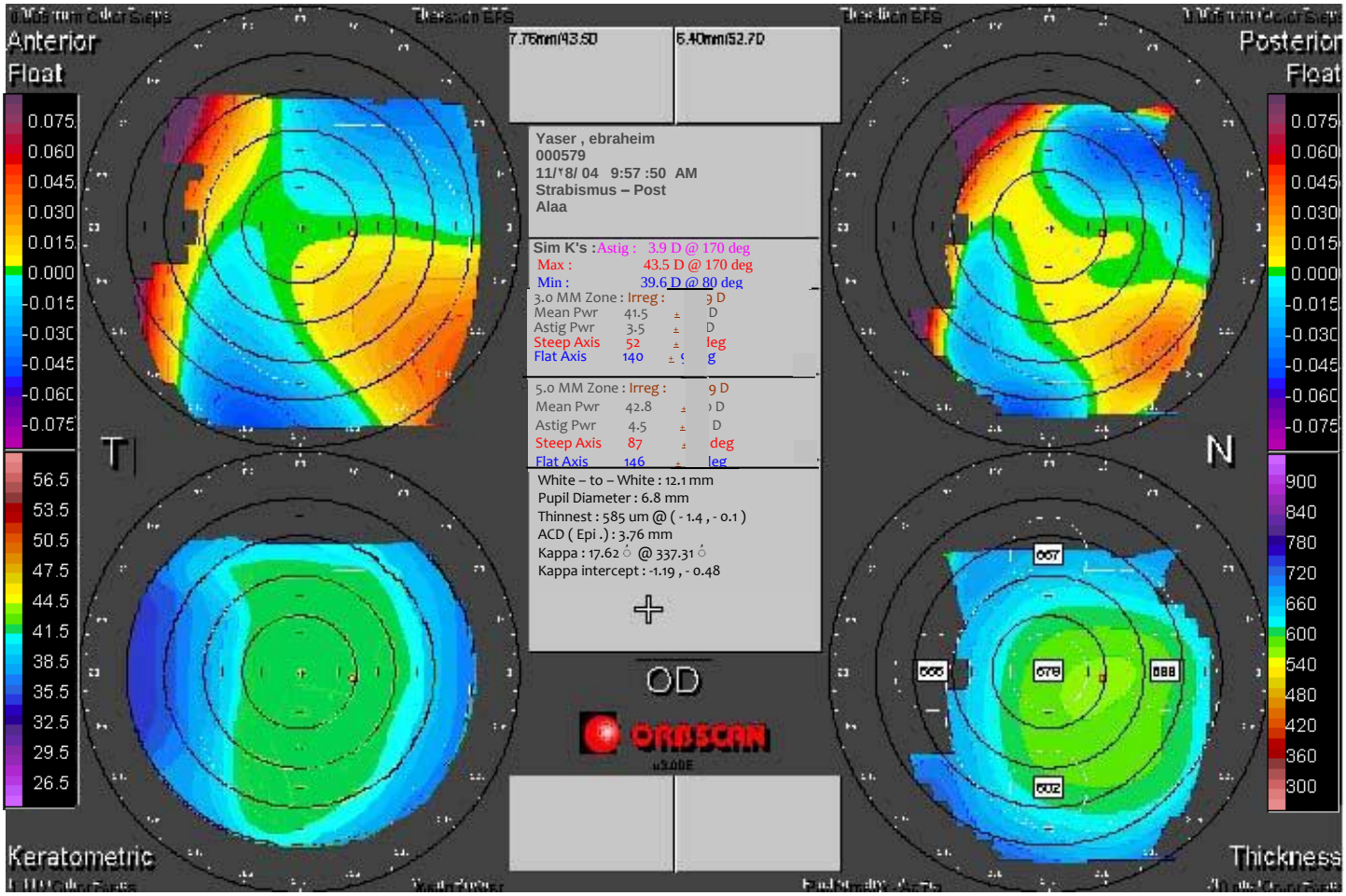

Fig. (53): case (4) – group (C) : one month postoperative

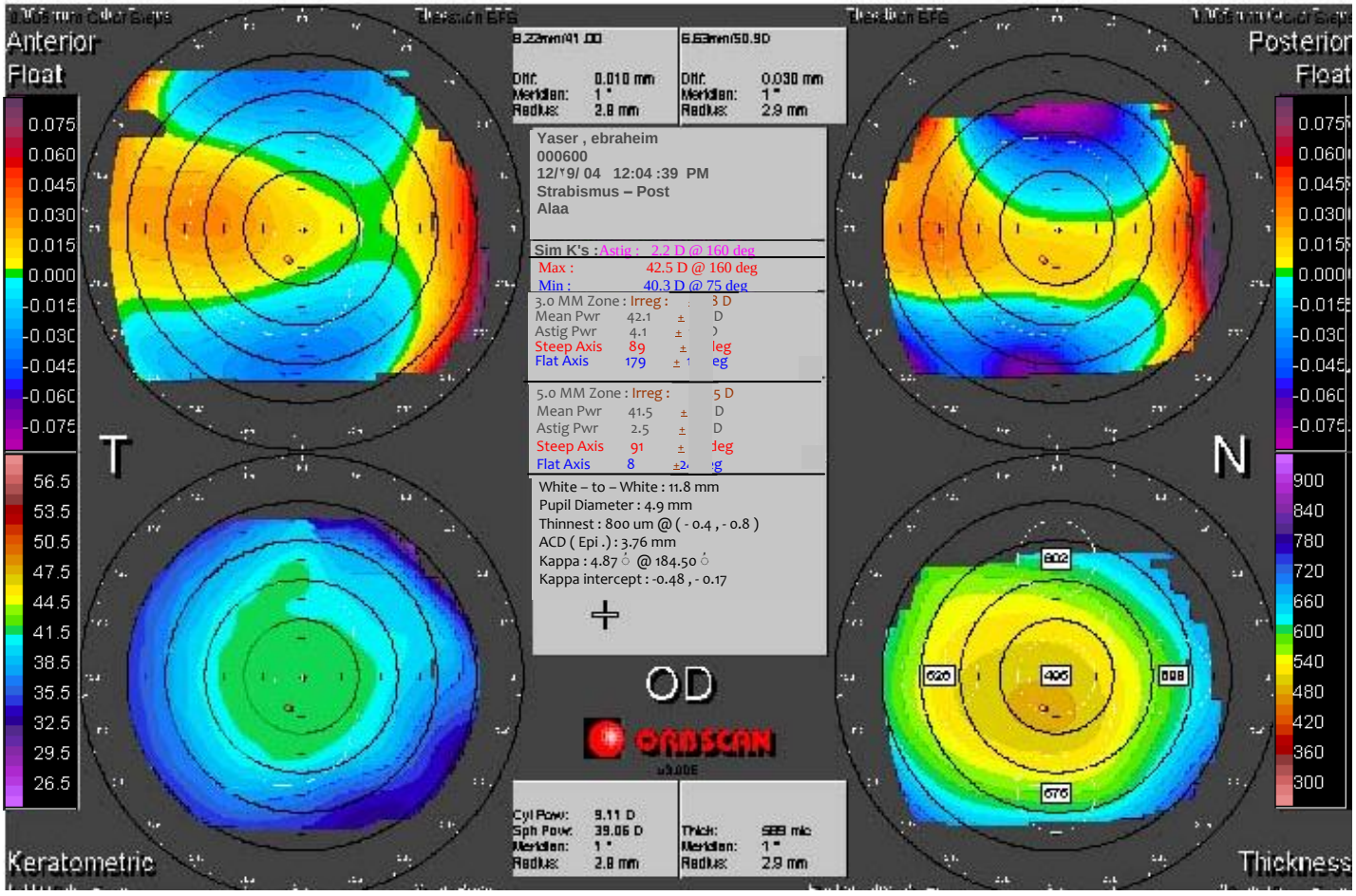

Fig. (54) : case (4) – group (C) : at two months postoperative