

Presbyopia Treatment with Excimer laser

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Presbyopia is an aging process that includes lens, ciliary body and zonule. Human can change focal point through the modification of lens shape and location. These processes undergo changes with age. Lens loses elasticity and ciliary body function decreases. There were many researches to treat presbyopia by surgery. One of them is corneal based surgery that make multifocal cornea. LTK and CK and excimer laser were used for this purpose. In this study, we evaluate the efficacy and safety of excimer laser for the treatment of presbyopia.

Patients and Method:

71 eyes of 38 patients were treated with NIDEK-EC 5000 CX2 (NIDEK, Gamagori, Japan). Surface ablations were used in all cases. The laser ablates cornea to make multifocality. Nidek laser ablates central zone for far vision and peripheral zone for near vision. (figure 1) In hyperopia group, 35 eyes of 20 presbyopia patients were treated with excimer laser. There were 10 men and 10 women. Mean age was 55 (45 ~70) years old. Mean preoperative spherical equivalent was +0.85 D (0.25 ~ 2.00). Mean add power was 2.25 D (2.00 ~ 2.50). Mean follow up was 8.9 months (6 ~ 16).

In myopia group, 36 eyes of 18 patients were enrolled. There were 9 men and 9 women. The mean age was 50 (44 ~ 72) years old. Mean preoperative spherical equivalent was -4.8 D (-1.0 ~ - 10.75). Add power was +1.7D (0.5 ~

3.0). Mean follow up was 8.2 months (6 ~18). (table 1) The preoperative and postoperative manifest refraction, distant and near visual acuity were measured.

Result

Predictability

In hyperopia group, the postoperative spherical equivalent was -0.12 ± 0.47 D. 88 % of eyes were within 0.5 D and 94% were within 1 D. In myopia group, postop spherical equivalent was -0.31 ± 0.40 D. 77 % of eyes were within 0.5 D and 97% were within 1 D. (figure 2)

Safety

In hyperopia group, distance visual acuity showed that 20% of eyes gain 1 or 2 line of vision and 80% did not change. There was no eye that loses line of vision. In myopia group, 39% of eyes gained one or more lines of vision in distance. There were 3% of eyes that lost 1 line of vision but there was no eye that lost two or more lines. Near visual acuity change showed that 100% in hyperopia and 92% in myopia gained 1 to 6 lines of vision and there was no eye that lost line of vision. (figure 3)

Distance and near visual acuity

34% of eyes in hyperopia and 53% in myopia showed more than 20/20 uncorrected distance vision. And 91% and 97% were more than 20/30 respectively. 26% of eyes showed 20/25(J1) and 93% reads 20/40(J3) or more in distance corrected near visual acuity in hyperopia. 36% were 20/25(J1) and 96% were 20/40(J3) or more in distance corrected near visual acuity in myopia. (figure 4) Enhancement was done in 11% of eyes in hyperopia and in myopia group. Scattergrams of distance and near visual acuity between preop and postop showed that there are marked improvements in both distance and near visual acuity in both groups. (figure 5)

Contrast sensitivity and night visual symptoms

Night visual problems were assessed through patient questionnaire. Contrast sensitivity test was done at 6 months postoperatively with CSV-1000 (Vector Vision, Greenville, OH, USA). Contrast sensitivity was reduced below to

normal range. (figure 6) Immediate after surgery, most patients experienced night visual problems. But after 6 months, these problems improved. 28% and 33% of patients complained of night visual symptoms in hyperopia and myopia respectively. 5% and 6 % of patients have difficulty in night driving. But 9 out of 10 patients did not use glasses at any time and satisfaction was very high. (table 2)

Discussion

There were many researches for the treatment of presbyopia with excimer laser. The purpose of the excimer ablation is to make multifocal cornea that can focus distance and near objects at the same time. There were two different approaches. One is center for near, periphery for far method, which uses central small island for near vision. The other is center for far, periphery for near method used in this study. In hyperopia, both methods are equally effective for improving near vision without loss of distance vision. But in myopia, both methods are less effective than in hyperopia. In this study, we used center for far, periphery for near method in hyperopia and our modification of multifocal ablation for myopia. We named this method as "Photopresbyopic keratectomy", simply, PPK. This study showed good results in both hyperopia and myopia groups and there was no eye that lost 2 or more lines of vision. Night visual symptoms can happen in every multifocal approach. The satisfaction rate in this study was very high despite of the night visual symptoms.

Conclusion

Excimer laser can be used as a safe and effective treatment method of presbyopia.

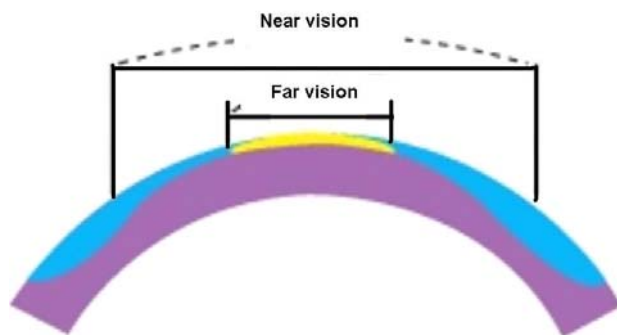
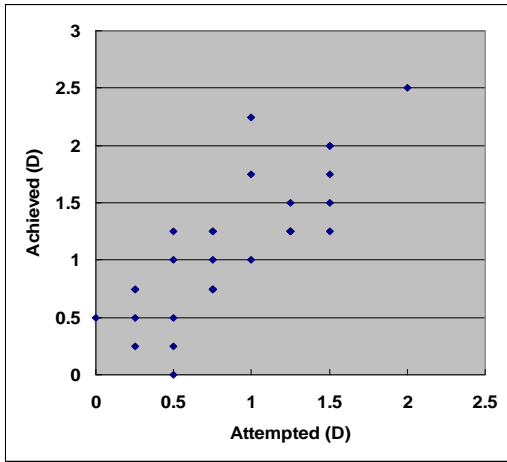
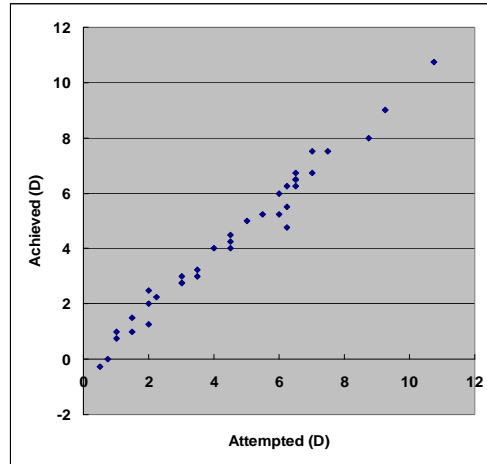


Figure 1. Multifocal cornea ablated by excimer laser.

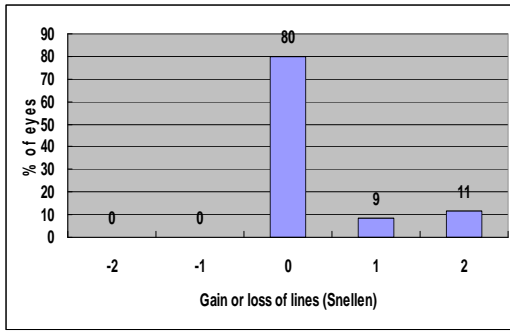


A



B

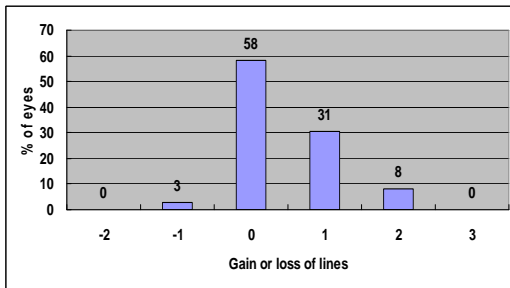
Figure 2. Scattergram of attempted versus achieved correction in hyperopia (A) and myopia (B). Predictability was good in both groups. 88% in hyperopia and 77% of eyes in myopia were within 0.5 D.



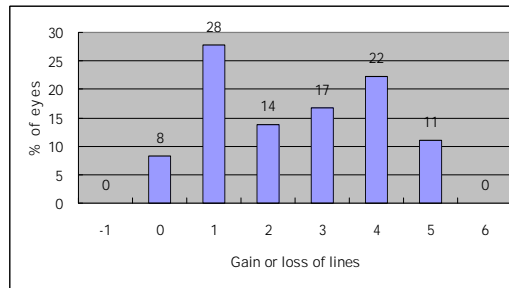
A



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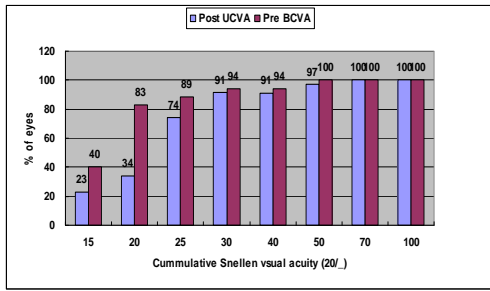


C

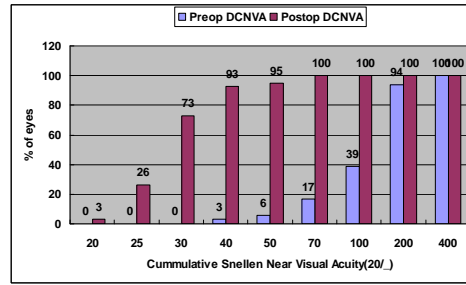


D

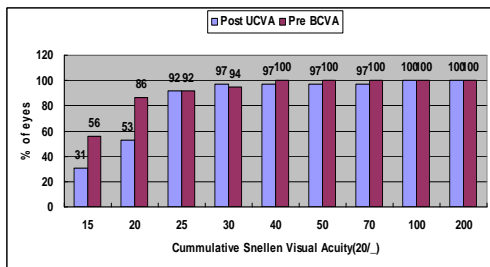
Figure 3. Change of visual acuity in hyperopia (A, B) and myopia (C, D) group for the distance (A, C) and near (B, D) vision. After surgery, distance vision was improved in 20%, 39% of eyes in hyperopia and myopia group respectively. Near visual acuity improved in 100% and 92% of eyes respectively from 1 to 6 lines.



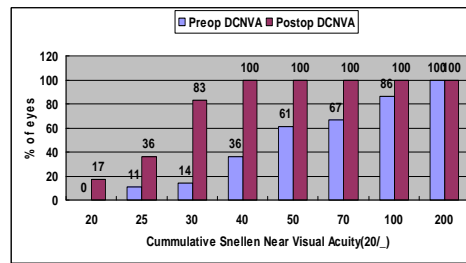
A



B



C



D

Figure 4. Postoperative distance visual acuity (A, C) and distance corrected near visual acuity (B, D) in hyperopia (A, B) and myopia (C, D) group. Vision improvement is marked especially in near vision in both groups.

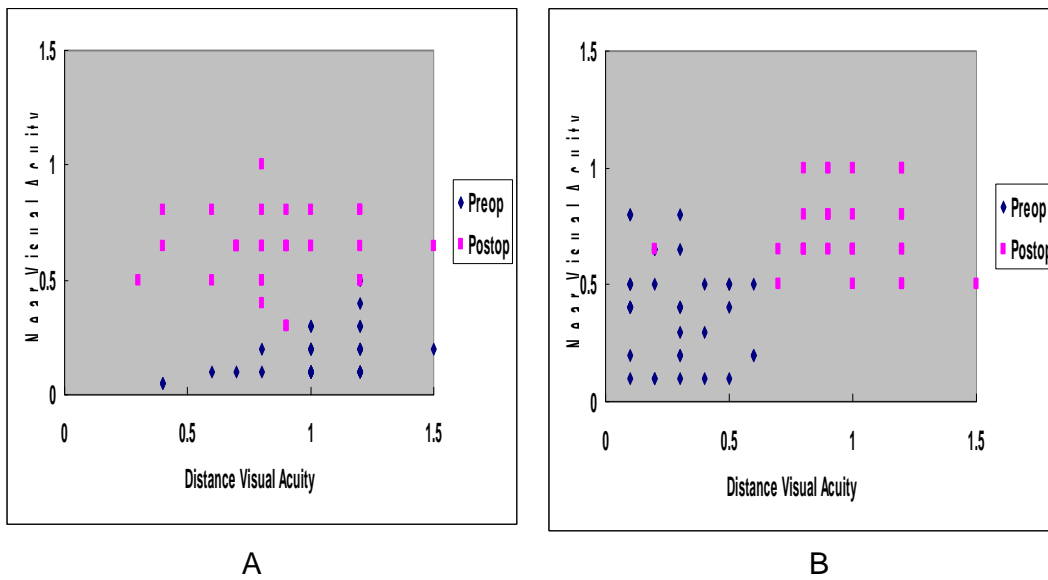


Figure 5. Scattergram of distance and near visual acuity at preop and postop in hyperopia (A) and myopia (B). There were marked improvements of distance and near vision in both groups.

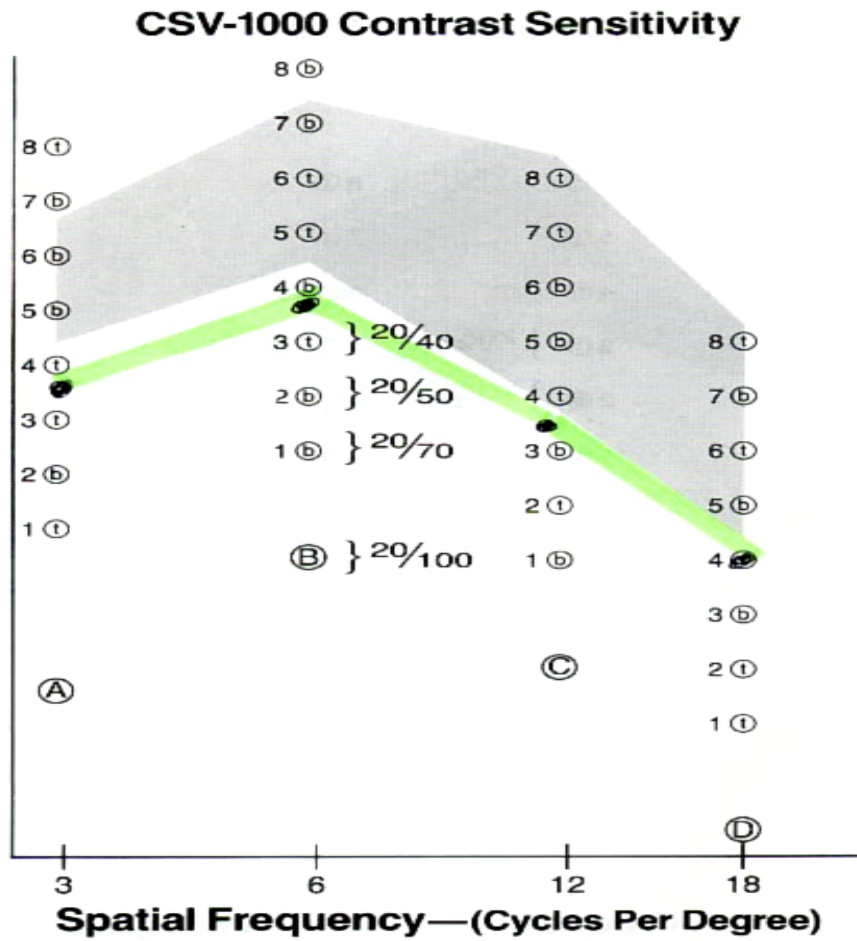


Figure 6. Contrast sensitivity test at 6 postoperative months. Contrast sensitivity was below normal range.

	Hyperopic group	Myopic group
Patients	35 eyes 20 patients	36 eyes 18 patients
M : F	10 M : 10 F	9 M : 9 F
Age (yr)	55 +/- 4.2	50 +/- 3.4
Preop SE (D)	+0.85 +/- 0.51	- 4.82 +/- 2.49
Add power(D)	+2.25 +/- 0.35	+1.66 +/- 0.32
Follow up (month)	8.9 +/- 3.4	8.2 +/- 2.3

Table 1. Patient data in hyperopic and myopic group.

	Hyperopia	Myopia
Night visual symptom	28%	33%
Driving difficulty	5%	6%
Free of glasses	86%	91%
Satisfaction	95%	96%

Table 2. Prevalence of night visual symptoms and patient satisfaction.