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Comparison Of Corneal Endothelial Characteristics In Soft Contact Lens Wearers With Non-Contact Lens Wearers

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Abstract:

Aim:

It is known that hypoxia Contact lenses may lead to alter physiology of the cornea and or morphological changes of corneal endothelial cells. This study aims to evaluate corneal endothelial characteristics of contact lens wearers with non-contact lens wearers and will compare the corneal endothelial characteristics with duration of the lens wear.

Methods:

Specular microscopy and Endothelial cell count measured by using TOPCON SP-1P non-contact specular microscope in subjects using contact lenses and age matched control eyes. Analysis of the same is done.

Result:

Mann-Whitney U test shows statistically significant co-efficient of variation 36.03±2.95 in control group and 40.73±5.527 in contact lens wearers (p =0.006) and pleomorphism (46.17±7.539 in control group 41.3±7.047in contact lens wearers p= 0.006) among contact lens wearers and non-contact lens wearers. Mean value of CV (coefficient of variation) was higher in contact lens wearers than control group. ECD (Endothelial cell density) cell area CCT (central corneal thickness) were almost similar. There were no statistically significant differences of pleomorphism of CV between short term wearers and long-term wearers, but it did reduce the cell density in long term users. There was no statistically significant difference between the endothelial characteristics in Hydrogel and Silicon Hydrogel contact lens wearers

Conclusion:

Soft contact lens wearers had corneal endothelial changes when compared to non-contact lens wearers. Polymegathism and pleomorphism was found to be higher in contact lens wearers when compared to non-wearers. These changes are evident in patients who wore lenses for less than 6 years also with no difference between the duration or the material.

Keywords: Contact lens, endothelium morphology, pleomorphism, cell density, coefficient of variation

I. INTRODUCTION

Hypoxia induced due to contact lens, the regularity of corneal endothelial morphology may be affected by the presence of ocular disease, ocular trauma, ocular surgery, contact lens wear, age and race. Prolonged lens wear may cause corneal hypoxia resulting in fluid accumulation in the stroma. The corneal endothelium consists of a single layer of flat hexagonal cells in a mosaic form. It controls corneal hydration and is permeable to oxygen and other nutrients from aqueous humor. Numerous investigators have demonstrated morphologic changes in the corneal endothelial cells of wearers of almost all contact lenses Such changes may be indicative of cell stress due to chronic hypoxia, which leads to lactate accumulation, elevated carbon dioxide levels, and pH changes. Hence the functional capacity of corneal endothelium may be correlated to its morphologic appearance.

Pleomorphism may be a sensitive indicator of the health of corneal endothelium and polymegathism may be indicative of altered cell function. Two possible methods of estimating

the degree of polymegathism in the endothelial mosaic are to examine the coefficient of variation (CV) of the cell areas and the ratio of maximum cell size/minimum (Max/Min) cell size. It is known that the polymegathism and pleomorphism increases slightly with age. There are a number of reports that indicate an increase in endothelial polymegathism and pleomorphism with polymethylmethacrylate (PMMA) hard contact lens, soft lens, and extended hydrogel lens wear. However, eyes wearing silicon lenses, which are highly permeable to oxygen, are expected not to develop significant changes. CD is a measurement of cell density in mm^2 and decreases with age. A low CD value for a particular age may indicate that the endothelium is depleting faster than normal. CV represents the coefficient, or degree, of variation in the sizes of the endothelial cells (polymegethism). By measuring the variation in size between endothelial cells, the system can measure how much cell loss is occurring. A CV less than 40 is normal. HEX indicates the variability in hexagonal cell shape over time. Hexagonality above 50% is suggested to be normal.

Average Cell Densities by Age[3]

Age	Average CD (cells/mm²)
10-19	2,900-3,500
20-29	2,600-3,400
30-39	2,400-3,200
40-49	2,300-3,100
50-59	2,100-2,900
60-69	2,000-2,800
70-79	1,800-2,600
80-89	1,500-2,300

Table 1: Age related Cell density : reference table (adapted from:

II. BACKGROUND

Dada V.K (1) in 1989 found that there was a significant reduction in cell density and change in cell size and shape in PMMA lens user.

Esgin H and Erda N (2) in 2002 studied the endothelial cell shape and size in ninety-seven eyes of 57 new wearers were fitted with a fluoroperm contact lens material RGP (Dk = 92 $x10^{-11}$) lens wearers and he found an increase in polymegathism.

Doughty M.J et al (3) in 2005 refitted hydrogel lens wearers to silicone lens wearers. Even though increased oxygen availability improved the external eye signs, polymegathism and pleomorphism still increased marginally.

Wiffen S.J et al (4) in 2000 compared the central and peripheral corneal endothelial cell morphometry in normal subjects and long-term contact lens wearers and found Peripheral CV was significantly higher than central for normal subjects and contact lens wearers and was significantly higher in both center and periphery in contact lens wearers than non wearers.

Duran M et al (5) in 2013 found that long term use of silicon hydrogel soft contact lens can also cause alterations in corneal endothelial cell structure.

Magdum RM et al (6) studied corneal endothelial changes after soft contact lens wear and correlated these changes with the duration of the soft contact lens wear controls and found significant difference in the corneal endothelial thickness, cell density, and hexagonality.

Reshma Ramakeishnan et al (2) in 2014, concluded that soft contact lens used on a daily wear basis control concluded that soft contact lens used on a daily wear basis induces changes in corneal curvature, endothelium, thickness and tear-film status. Norhani Mohidin et al (3) in 2013 16 studied corneal endothelial cell morphology in short term silicon hydrogel soft contact lens wearers.

contact lens wearer for 24 months on a daily wear basis. The result showed no significant differences in endothelial cell density, coefficient of variation of endothelial cell size and percentage of hexagonal cells between the silicone hydrogel soft contact lens wearers and controls.

Chanq SW et al (2) in 2001 reported increasing span of contact lens wear, there was a significantly increased variation in cell size, a decreased hexagonal cell percentage, an evident intercellular dark area and rosette formation. Contact lens wear also caused corneal thinning, and the cornea became thinner with increasing duration of contact lens wear.

Lee et al, 2001 A lower ECD on the central cornea (2613.6 ±215.8 cells per mm^2) was noted only in contact lens wearers who have worn their lenses for 6 years or more as compared to non-contact lens wearers (2902.5 ±200.5 cells per mm^2).

III. AIM AND OBJECTIVES

Our study is done to evaluate corneal endothelial characteristics of contact lens wearers and non-contact lens wearers and compare mean thickness m cell density, pleomorphism and mean coefficient of variation in contact lens wearers (short term and long term) and non-contact lens wearers. It will compare the above parameters between hydrogel with silicone hydrogels and identify if there was any correlation of the lens wear duration on these characteristics.

IV. METHODOLOGY

This observational, cross sectional study was carried out in 240 eyes of 120 soft contact lens users, aged between 18 and 30 years who visited tertiary hospital. Regular contact lens users wearing soft lenses, for a minimum of 8 hours and more than 2 years were included in the study. Those with the frequency of wear was at least 5 days in a week were only included and the patients with systemic disease; irregular contact lens users; extended wearers; history of ocular surgery or trauma; pregnant or lactating females wear excluded from the study.

120 patients who visited a tertiary hospital were included in the study which included 60 patients who were not using contact lenses and they served as controls. Both eyes of 60 patients who were using either soft hydrogel or silicone hydrogel lenses served as the study group. In the study group,

26 eyes were myopic, 11 were hyperopic and 23 were compound myopic.

120 eyes of CL users from 2 to 20 years were enrolled of which 30 eyes were less than 6 years and 30 eyes were long term users. The mean daily wear of the enrolled patients was 10±1.781 hours. 60 eyes wore hydrogel lenses and 60 wore silicone hydrogel and none of them wore the lenses on an extended wear basis. All the controls were emmetropic. The mean age of the control group was 25.33±3.79 years and that of the study group was 27.53±3.758 years.

Consent was taken from patients who were enrolled for the study.

Central corneal thickness (CCT), endothelial cell density, endothelial cell area, hexagonality (pleomorphism), coefficient of variation, was obtained using the TOPCON SP-1P non-contact specular microscopy specular microscope. These parameters were compared between contact lens wearers and non-wearers.

Based on Lee et al study the contact lens wearers were further divided into 2 groups: short term users (patients who were using lenses for less than 6 years) and long- term users (patients who were using lenses for equal to greater than 6 years).

All the parameters were compared between these two groups.

The data was entered into Microsoft Excel spreadsheet and analyzed using SPSS statistical software. Paired T test, frequency value for age classification, independent one sample test, pearsons correlation with p value set as p<0.005. Comparison was done using Mann-Whitney U test.

V. RESULTS

Table 1 compares values between the control and the contact lens wearers .Table 2 compares between the long term and short term users and Table 3 compares the cell morphology chnegs in hydrogel with silicone hydrogel material.

	Control Group		Contact lens wearers		p value
	Mean	SD	Mean	SD	
CD/mm2	2700.8	230.51	2685.07	217.783	0.853
Cell area mm2	374.93	35.869	374.93	31.17	0.912
CV%	36.03	2.953	40.73	5.527	0.001
Pleomorphism	46.17	7.539	41.3	7.047	0.006
CCT µm	495.1	40.754	506.43	39.636	0.145

Table 1: Comparison of endothelial parameters between control group and contact lens wearers

	Short term wearers		Long term - wearers		p value
	Mean	SD	Mean	SD	
CD/mm2	2581.4	236.7	2154.17	178.93	0.05
Cell area mm2	390.42	35.357	364.61	23.801	0.05
CV%	42	6.075	39.89	5.132	0.299
Pleomorphism)	41.08	7.775	41.44	6.749	0.916
CCT µm	504.5	51.873	507.72	30.569	0.719

Table 2: Comparison of endothelial parameters between short term wearers and long-term wearers

	Hydrogel		Silicon Hydrogel		p value
	Mean	SD	Mean	SD	
CD/mm2	3188.69	280.81	3197.47	249.5	0.860
Cell area mm2	334.3	29.89	331.94	30.62	0.712
CV%	35.53	3.688	35.88	5.904	0.126
Pleomorphism	35.30	4.28	35.52	6.98	0.067
CCT µm	515.84	32.809	507.47	23.701	0.916

Table 3: Comparison of endothelial parameters between Hydrogel and Silicon Hydrogel lens wearers

ENDOTHELIAL CELL DENSITY (ECD)

There is no statistically significant difference between contact lens wearers and controls

p=0.85), hydrogels and silicone hydrogels. but shows significant difference between short term wearers and long-term wearers (p=0.05)

ENDOTHELIAL CELL AREA

The cell area in contact lens users varied from 328 to 445 mm 2 with a mean of 374.93±31.170 mm 2 and was 374.93±35.869 mm 2 in the control group and was not comparable. However, there was statistically significant difference found in cell area between the duration of the wear.

COEFFICIENT OF VARIATION (CV)

CV in contact lens users varied from 30 to 51% with a mean of 40.73±5.527% compared to controls from 31 to 44% with a mean of 36.03±2.953%. The CV in short term wearers ranged from 30 to 51% The mean was 42±6.075% and in long term wearers it ranged from 32 to 50%. And the mean was 39.89±5.132%. This was statistically significant when compared between contact lens user with non user cornea.

PLEOMORPHISM (HEXAGONALITY)

Pleomorphism in contact lens users varied from 29 to 61 with a mean varying from 29 to 55 with a mean of 41.30±7.047. Pleomorphism in controls varied from 21 to 57 with a mean of 46.17±7.539. In short term wearers ranged from 30 to 55 and mean was 41.08±7.775.

In long term wearers it ranged from 29 to 54 with the mean of 41.44±6.749. This parameter was statistically significant different between contact lens wearers and controls (p<0.01).

There is no statistically significant difference between short term wearers and long-term wearers (p=0.719).

CENTRAL CORNEAL THICKNESS (CCT)

CCT in contact lens users varied from 397 to 579 with a mean of 506.43±39.636 µm. CCT in controls varied from 383 to 609 µm with a mean of 495.10±40.754 µm.

In long term wearers it ranged from 440 to 546 µm in the left eye with the mean of 507.72±30.569 µm. There is no statistically significant difference between contact lens wearers and controls (p=0.145) and also between short term wearers and non-wearers (p=0.916) in terms of CCT.

There is no statistically significant difference of CCT between SiHy users and Hy users (p=0.916).

VI. DISCUSSION

In our study statistically significant difference was found for coefficient of variation and pleomorphism among contact lens wearers and non-wearers. The mean value of CV was higher in contact lens wearers than controls hence increased polymegathism induced by lenses. The mean value of pleomorphism is found to be lesser in contact lens wearers than controls which indicate that endothelial cells of soft contact lens wearers lose their hexagonality. Pleomorphism is an indicator of the health of corneal endothelium and its altered cell function. Coefficient of variation (CV) of the cell areas and the ratio of maximum cell size/minimum (Max/Min) cell size higher number indicates an increase in endothelial polymegathism and pleomorphism indicative of endothelial stress in the contact lens corneas duration of wear and material had no impact on these parameters however the cell density remains almost similar.

Other parameters like ECD, cell area, CCT were not statistically significant. The key indicators of endothelial cell function are polymegathism and pleomorphism. Both of these were found to be increased in contact lens wearers, this shows that wearing contact lenses change the endothelial characteristics. This finding was in accordance with other studies. But in other studies, there was significant difference for ECD also which was not the case in our study.

The result of our study did show changes in cell density in long term users. In our study statistically significant value was not found for the parameters like Central Corneal Thickness, Endothelial Cell Density, Coefficient of Variation, Hexagonality 6A and Cell area in materials of hydrogel and Silicon Hydrogel contact lens wearers.

There are many factors that can affect the morphology of endothelial cell and some changes in the morphology of corneal endothelial cells in contact lens wearers are attributed to chronic hypoxia. All Contact lenses have been shown to induce changes in the morphology of corneal endothelium and does not differ if we shift to Silicone hydrogel material. The authors concluded that extended wearing time of contact lenses is a factor that affected the morphology of corneal endothelial cells rather than lens types. Similar results were obtained by Lee et al who investigated the morphology of corneal endothelial cells in soft contact lens wearers with wearing time more than 6 years.

The corneal thickness was found to be slightly more, though not statistically. The values may have been recorded higher due to corneal edema as these readings were taken soon after removal of the contact lens.

VII. CONCLUSION

Form this study we conclude that soft contact lens wearers had corneal endothelial changes when compared to non-contact lens wearers. Polymegathism and pleomorphism was found to be higher in contact lens wearers when compared to non-wearers. These changes are evident in patients who wore lenses for less than 6 years also. There is no statistically significant difference in these changes when compared between Hydrogel and Silicon Hydrogel contact lens wearers.

REFERENCES

[1] Perez-Santonja, J.J., Sakla, H.F., Gobbi, F. & Alio, J.L. Corneal endothelial changes after laser in situ keratomileusis. J. Cataract Refrac. Surg. 1997. 23: 177-183.
[2] Bourne, W.M. The effects of long-term contact lens wear on the cells of the cornea. CLAO 2001. 27(4): 225-30.
[3] 3. Lee, J.S., Lee, J.E., Choi, H.Y., Oum, B.S. & Cho, B.M. Corneal endothelial cell changes after phacoemulsification relative to the severity of diabetic retinopathy. J. Cataract Refract. Surg. 2005. 31: 742-49
[4] Sheng, H. & Bullimore, M.A. Factors affecting corneal endothelial morphology. Cornea 2007. 26 (5): 520-525.
[5] Abbey Johnson Bonnell, O.D., and Mike Cymbor, O.D. Under the Specular Microscope. https://www.reviewofoptometry.com/article/under-the-specular-microscope, August 15, 2012.
[6] Specular Microscope SP-1P. http://www.topcon.co.jp/en/eyecare/products/product/diagnostic/sp/SP-1P_E.html, sep 9,2015
[7] Dada VK, Jain AK, Metra MR. specular microscopy of unilateral hard contact lens wearer. Indian J ophthalmol 1989; 37:17-9.
[8] Esgin H, Erda N. Corneal endothelial polymegathism and pleomorphism induced by daily-wear rigid gas-permeable contact lenses. CLAO journal 2002; 28:40-43.
[9] Doughty MJ, Aakre BM, Ystenaes AE, and Svarverud E. Short –Term of the human corneal endothelium to continuous wear of silicon hydrogel (Lotrafilcon A) contact lenses after daily hydrogel lens wear. Optometry Vision Science 2005;.82:473-6
[10] Wiffen, Steven JH, Bourne DO, William M. The Effect of contact lens wears on the central and peripheral corneal endothelium. Journal A-Z 2000; 19: 47-51.
[11] Duran m, Yeter V, Sayin O, Birinci H, Gungor I. Corneal endothelial changes in patient wearing soft contact lens. Journal of experimental and clinical medicine2013; 30:27-29.

[12] Magdum RM, Mutha N, Maheshgauri R, A study of corneal endothelial changes in soft contact lens wearers using non-contact specular microscopy. Medical journal of Dr.D.Y Patil University2013; 6:3.
[13] Reshma Ramakrishnan, Amol D Kadu, Abhijit Naik, Corneal changes in soft contact lens wearers. DOI: 10.4103/2320-3897.174419 J Clin Ophthalmol Res. 2016; 4:40-2.
[14] Carlson KH, Bourne WM, Brubaker RF. Effect of long-term contact lens wear on corneal endothelial cell morphology and function. Department of Ophthalmology, Mayo Clinic, Rochester, MN 55905. Invest Ophthalmol Vis Sci 1988 Feb;29(2):185-93.
[15] Kirsi Setälä, Kristiina Vasara, Eija Vesti, Pekka Ruusuvaara, Effects of long-term contact lens wear on the corneal endothelium, 26 June 2003, https://doi.org/10.1034/j.1600-0420.1998.760309.x
[16] Norhani Mohidin Ngu Lee Hoon, Bashirah Ishak, Bariah Mohd-Ali. Corneal endothelial morphology in short- term silicon hydrogel soft contact lens wearers - Asian Context. January, 2014. https://www.researchgate.net/publication/280495564
[17] Chanq SW, Hu FR, and Lin LL. Effect of contact lens on corneal endothelium. A morphological and functioinal study. Ophthalmologica -Jun; 215(3):197-203.
[18] Lee, J.S., Park, W.S., Lee, S.H., Oum, B.S. & Cho, B.M. A comparative study of corneal endothelial changes induced by different durations of soft contact lens wear. Graefe's Arch. Clin. Exp. Ophthal. 2001. 239: 1-4.
[19] N Kurysheva* and E Shatalova. Polymegathism, Pleomorphism, and Endothelial Cell Count after Selective Laser Trabeculoplasty. October 07, 2016, Biol Med (Aligarh) 8: 343. doi:10.4172/0974-8369.1000343.
[20] Craig Thomas, O.D. Growing Your Practice with Specular Microscopy, June 24, 2008, https://www.ophthalmologyweb.com/Tech-Spotlights/26491-Growing-Your-Practice-with-Specular-Microscopy/.