International Journal of Medical and Pharmaceutical Research
Website: https://ijmpr.in/ | Print ISSN: 2958-3675 | Online ISSN: 2958-3683
NLM ID: 9918523075206676
Volume: 4 Issue:2 (Mar-Apr 2023); Page No:555-559

Research Article

IJMPR

Comparative Study of Corneal Endothelial Changes Among Contact Lens Wearers and Spectacle Users Using Non-Contact Specular Microscopy

Dr Raksha Kini[1], Dr Pradeep A V[1], Dr Varsha S B[1], Dr Shruthi KP[1]

[1] Department of Ophthalmology, MIMS, Mandya

ABSTRACT

The purpose of this study was to assess the changes in the corneal endothelial cells of medical students and doctors who used soft hydrogel contact lenses for myopia correction during a three-month period.

The study included 50 subjects, with 25 wearing contact lenses and the remaining participants wearing spectacles. The morphology of corneal endothelial cells in both groups was assessed using a specular microscope to determine endothelial cell density, coefficient of variation, hexagonality, and central corneal thickness.

At baseline (p-value = 0.14) and 3 months (p-value = 0.07), there was no statistically significant difference in refraction between Group A (-2.460.96 diopters) and Group B (-2.831.55 diopters). Similarly, at baseline (p-value = 0.26) or 3 months (p-value = 0.96), there is no statistically significant difference in ECD between Group A (3108.19228.30 cells/mm2) and Group B (3012.53225.95 cells/mm2). Furthermore, p-values larger than 0.05 show no statistically significant difference in COV, HEX, or CCT between the two groups at either time point.

The study concluded that the absence of change in corneal endothelial cell shape is most likely attributable to the contact lens material's good oxygen permeability, compliance, and short wearing period.

Key Words: *corneal endothelial cells, soft contact lens, myope, non contact specular microscopy*

***Corresponding Author**
Dr Raksha Kini
Department of Ophthalmology, MIMS, Mandya.

INTRODUCTION

The endothelium, or innermost layer of the cornea, is made up of a single layer of closely packed, flattened cells that face the front chamber of the eye. Age, contact lens wear [1,2], diabetes, ocular surgery, and ethnicity can all have an effect on the shape of these cells. In young adults, contact lens usage has been associated to alterations in the shape of corneal endothelial cells [2]. These alterations must be closely monitored since they can impair the function of these cells and result in vision loss. Traditional hydrogel soft contact lens studies have revealed considerable changes in the corneal endothelial layer [2,3]. Hydrogel lenses with limited oxygen permeability can cause persistent corneal hypoxia, which can lead to alterations in the shape of corneal endothelial cells [4]. To prevent these changes, a minimal amount of oxygen must travel through the contact lenses to the cornea (5). According to a mathematical model of oxygen diffusion across the cornea, a minimum threshold of 125109 (cm2/sec)mL O2/mL mmHg oxygen transmissibility is required for extended wear contact lenses [4].

Lee et al. [6] investigated the effect of corneal endothelial morphology on the duration of daily wear soft contact lens wearing periods. They discovered a link between the duration of soft contact lens use and morphologic changes in the corneal endothelium. Soft contact lens users had a higher coefficient of variation in cell size than non-contact lens users. When compared to the control group, those who had been wearing soft contact lenses for more than 6 years had a lower proportion of hexagonal cells and a lower mean corneal endothelial cell density (ECD). An previous study [4] also found that the time of wearing traditional soft hydrogel contact lenses is associated with an increased rate of corneal endothelial polymegathism, although this tendency was not seen in high oxygen permeability (Dk) silicone hydrogel contact lens wearers [7].

Mohidin et al. [8] studied the morphologic state of corneal endothelial cells in silicone hydrogel contact lens wearers who had used their lenses daily for up to 24 months. Their findings revealed a minimal variation in the shape of corneal endothelial cells between contact lens wearers and non-contact lens users, which they attributed to the high oxygen permeability of contact lens materials and the short length of lens wear. The majority of contact lens wearers in their study used their lenses for about 11 hours every day.

The goal of this study was to investigate the effects of wearing soft hydrogel contact lenses for three months on the morphology of corneal endothelial cells in young myopic participants. Soft hydrogel contact lenses are widespread in

Asia, although there are little studies on Asian eyes. According to Hamano et al [9], there is a considerable differential in the corneal response to oxidative stress between Asian and non-Asian eyes. Their findings revealed that Asian eyes had much more endothelial bleb development during closed eye conditions than the non-Asian population. Doughty [10] investigated the architecture of the Asian corneal endothelium and determined that polymegethism is unusual in young Asian individuals who are healthy. It is likely that ethnicity influences corneal reaction to contact lens usage, but there are few data on this.

In this study, young myopic patients wore hydrogel contact lenses and the results were compared to those who were prescribed spectacles. The researchers wanted to see what happened to the corneal endothelial cells of medical students and clinicians who used soft hydrogel contact lenses for myopia correction for three months. The study involved 50 subjects, with 25 wearing contact lenses and the remaining participants wearing glasses. The corneal endothelial cell morphology of both groups was assessed using a noncontact specular microscope to determine endothelial cell density, coefficient of variation, hexagonality, and central corneal thickness. Data were obtained at the start and after three months of lens usage. The study's findings were utilised to assess whether there was any substantial change in corneal endothelial cell morphology after three months of wearing soft hydrogel contact lenses, as well as the potential causes of the alterations.

Materials and methods

This was a prospective comparative study conducted over a period of 3 months, in Department of Ophthalmology, MIMS, Mandya. Based on previous studies, S.D for CCT is 52.12 (Study by Renu M. Magdum et al)[11], using the formula $N = z^2\ \sigma^2/ d^2$, Where z = 1.96, σ = S.D of CCT ie 52.12, d = 20% absolute error. $N = (1.96)^2\ (0.52)^2 / (0.20)^2 =$ 25.96 approximate to 25.

Data Collection:

After obtaining informed written consent, subjects who used contact lenses for myopia correction and met the inclusion criteria were considered for the study. At baseline, demographic information and pertinent history were collected from the patient. A comparative observational study was conducted on 50 myopic eyes, 25 of whom were soft contact lens users aged 19 to 30 years, and 25 who used spectacles and had never worn contact lenses. The duration, pattern of contact lens use, symptoms, brand name, number of years worn, and hours of daily wear were all noted in the clinical history and examination findings. Non-contact specular microscopy was used to assess endothelial cell shape and count.

Inclusion criteria:

- Medical students and doctors using soft contact lens for myopic correction for minimum of 1 year duration
- Age between 19 to 30 years.

Exclusion criteria:

- Patients with histories of any ocular disease like Ocular trauma, Glaucoma, Uveitis and eyes with anterior segment surgery were excluded from the study.
- Patients who had suffered attacks of over wear syndrome were excluded from the study.
- Patients who don't give consent for the study.

The subjects were separated into two groups: A and B. Subjects using Daily wear soft hydrogel contact lenses were assigned to Group A, while those wearing spectacles were assigned to Group B. All measurements were taken at the start and after three months of wearing lenses. Subjects were advised to wear their prescription for a maximum of 8 to 10 hours each day, and they were obliged to do so every day. For contact lens maintenance, contact lens wearers were also given multipurpose solutions, saline, and rewetting eye drops. The paired t-test was used to assess the results, with P 0.05 considered significant.

Results

This study involved 50 participants, with 12 males and 38 females. All participants provided written informed consent. According to the data, the majority of the subjects in both groups were female, with Group A having 20 female subjects and 5 male subjects (80 percent female) and Group B having 18 female subjects and 7 male subjects (80 percent female) (72 percent female). The subjects in both groups have similar mean ages, with Group A having a mean age of 22.46±0.83 years and Group B having a mean age of 22.04±1.63 years. The mean refraction, or the amount of lens power necessary to correct the subject's vision, is -2.47±0.86 diopters for Group A and -2.932±0.92 diopters for Group B.

Table 1: Demography of subjects

	Group A (n=25)	**Group B (n=25)**	**Total (n=48)**
Gender (F/M)	20/5	18/7	38/12

	Group A (n=25)	Group B (n=25)	Total (n=48)
Mean age (years)	22.46±0.83	22.04±1.63	21.43±1.3
Mean refraction (DS)	–2.47±0.86	–2.932±0.92	–2.57±1.3

Note: Group A, subjects wearing soft contact lenses; Group B, subjects wearing spectacles.

The results of corneal morphology measurements are as follows.

The mean refraction at baseline for Group A is -2.46±0.96 diopters and for Group B is -2.83±1.55 diopters. At 3 months, the mean refraction for Group A is -2.45±1.03 diopters and for Group B is -2.63±1.51 diopters. The p-values for these comparisons are 0.14 and 0.07 respectively, which suggests that there is no statistically significant difference in refraction between the two groups at either time point.

The baseline mean endothelial cell density (ECD) for Group A is 3108.19±228.30 cells/mm2 and for Group B is 3012.53±225.95 cells/mm2. At 3 months, the mean ECD for Group A is 3106.23±263.51 cells/mm2 and for Group B is 3018.56±256.95 cells/mm2. The p-values for these comparisons are 0.26 and 0.96 respectively, which suggests that there is no statistically significant difference in ECD between the two groups at either time point.

The baseline mean coefficient of variance (COV) for Group A is 47.32±8.63% and for Group B is 48.63±9.31%. At 3 months, the mean COV for Group A is 46.65±10.01% and for Group B is 48.54±10.65%. The p-values for these comparisons are 0.63 and 0.85 respectively, which suggests that there is no statistically significant difference in COV between the two groups at either time point.

The baseline mean hexagonality (HEX) for Group A is 47.59±10.12% and for Group B is 49.45±10.4%. At 3 months, the mean HEX for Group A is 46.96±10.01% and for Group B is 48.96±9.6%. The p-values for these comparisons are 0.36 and 0.49 respectively, which suggests that there is no statistically significant difference in HEX between the two groups at either time point.

The baseline mean central corneal thickness (CCT) for Group A is 523.36±0.03 µm and for Group B is 531.00±0.04 µm. At 3 months, the mean CCT for Group A is 522.59±0.04 µm and for Group B is 528.00±0.05 µm. The p-values for these comparisons are 0.56 and 0.49 respectively, which suggests that there is no statistically significant difference in CCT between the two groups at either time point.

Overall, this data suggests that there is no statistically significant difference in corneal health measures between the two groups at either the baseline or 3-month time point, regardless of whether the subjects were wearing soft contact lenses or spectacles. Table 2.

Table 2: Summary of results

	Group A (n=24)	Group B (n=24)	*P*
Refraction (DS**)**			
Baseline	–2.46±0.96	–2.83±1.55	0.14
3 months	–2.45±1.03	–2.63±1.51	0.07
ECD (cell/mm^2)			
Baseline	3108.19±228.30	3012.53±225.95	0.26
3 months	3106.23±263.51	3018.56±256.95	0.96
COV (%)			
Baseline	47.32±8.63	48.63±9.31	0.63
3 months	46.65±10.01	48.54±10.65	0.85
HEX (%)			
Baseline	47.59±10.12	49.45±10.4	0.36
3 months	46.96±10.01	48.96±9.60	0.49
CCT (µm)			
Baseline	523.36±0.03	531.00±0.04	0.56

	Group A (n=24)	Group B (n=24)	*P*
3 months	522.59±0.04	528.00±0.05	0.49

Note: Group A, subjects wearing soft contact lenses; Group B, subjects wearing spectacles.
Abbreviations: CCT, central corneal thickness; COV, coefficient of variation; ECD, endothelial cell density; HEX, hexagonality; DS, Diopter sphere.

DISCUSSION

The purpose of this study was to look at the effects of wearing soft hydrogel contact lenses for three months on the morphology of corneal endothelial cells in medical students and doctors who had been using contact lenses for myopia correction for at least a year. The study's findings revealed that there were no significant differences in corneal endothelial cell morphology between those wearing soft hydrogel contact lenses and those wearing spectacles. Despite having no prior experience with contact lenses, the participants reported feeling at ease wearing them. They were given multipurpose solutions and rewetting eye drops for maintenance and told to follow the optometrists' instructions. During the follow-up visits, there were no reported adverse events or complaints, and their refractive error remained steady throughout the study period.

Contact lens usage is one of the most frequently recognised factors that can change the shape of corneal endothelial cells. Chronic hypoxia caused by longer wearing time has been linked to changes in the shape of corneal endothelial cells in contact lens wearers [4]. In this study, the contact lens material's high oxygen permeability and short duration of usage (about 11 hours/day) likely prevented these alterations from occurring. The findings are consistent with prior research [8,12], which demonstrated no alterations in endothelial cell shape between soft contact lens wearers and non-wearers. It has been demonstrated that conventional hydrogel contact lenses cause alterations in the morphology of the corneal endothelium. Setälä et al [13] studied if the type of contact lens and length of time worn alter the morphology of corneal endothelial cells and discovered that longer contact lens wearing time induced pleomorphism, polymegathism, and a decrease in ECD. The authors concluded that the length of time contact lenses were used, rather than the type of lens, was the most important factor influencing the shape of corneal endothelial cells. Similar outcomes were obtained by

Lee et al. [6] investigated the morphology of corneal endothelial cells in soft contact lens wearers with more than 5 years of experience. They discovered that as contact lens use time rose, the ECD and HEX reduced while the COV increased. However, it is now widely accepted that extended-wear hydrogel soft contact lenses with limited oxygen transmissibility are the primary cause of corneal hypoxia, which then results in alterations in corneal endothelial morphology. The clinical success of newer generations of hydrogel lenses with increased water content, which increases oxygen permeability but does not prevent considerable overnight corneal swelling, has been demonstrated [14,15]. Previous research has demonstrated that hydrogel lenses with a higher water content reduce hypoxic clinical symptoms in the majority of participants who use them on a daily basis [14,15].

This study found no significant variation in the percentage of HEX and CCT before and after 3 months of contact lens usage. This is consistent with previous research, which found no significant change in the HEX of silicone hydrogel contact lens wearers versus non-wearers [8]. It is possible that no morphologic changes were observed after 3 months of wearing the contact lenses due to the high oxygen permeability of the hydgel contact lens material (Dk = 19.6 1011 (cm2/sec)mL O2/mL mmHg), short duration of contact lens wear (approximately 11 hours daily), and good compliance.

Overall, this study sheds light on the impact of wearing soft hydrogel contact lenses for three months on the morphology of corneal endothelial cells in medical students and professionals. The findings imply that using soft hydrogel contact lenses with high oxygen permeability and compliance, as well as wearing them for a shorter period of time, may help to prevent major changes in the morphology of corneal endothelial cells. These findings add to the body of knowledge on contact lens wear and its implications on corneal health, and they may assist optometrists and other eye care professionals in better understanding the risks and advantages of contact lens use among medical students and doctors.

CONCLUSION

This study concluded that the morphology of the corneal endothelial cells did not change significantly after three months of wearing hydrogel contact lenses. This is most likely due to the contact lens material's high oxygen transmissibility, the relatively short wearing period, and the outstanding contact lens compliance.

REFERENCES

1. Sheng H, Bullimore MA(2007). Factors affecting corneal endothelial morphology. *Cornea*; 26(5):520–525.
2. Bourne WM(2001). The effect of long-term contact lens wear on the cells of the cornea. *Clao J.*; 27(4):225–230.

3. Carlson KH, Bourne WM, Brubaker RF(1999). Effect of long-term contact lens wear on corneal endothelial cell morphology and function. *Invest Ophthalmol Vis Sci*; 76(10):712–719.
4. Schoessler JP, Woloschack MJ(1981). Corneal endothelium in veteran PMMA contact lens wearers. *ICLC*; 8:19–25.
5. Harvitt DM, Bonanno JA(1999). Re-evaluation of the oxygen diffusion model for predicting minimum contact lens Dk/t values needed to avoid corneal anoxia. *Optom Vis Sci*; 76(10):712–719.
6. Lee JS, Park WS, Lee SH, Oum BS, Cho BM(2001). A comparative study of corneal endothelial changes induced by different durations of soft contact lens wear. *Graefes Arch Clin Exp Ophthalmol*; 239(1):1–4.
7. Covey M, Sweeney DF, Terry R, Sankaridurg PR, Holden BA(2001). Hypoxic effects on the anterior eye of high-Dk soft contact lens wearers are negligible. *Optom Vis Sci*; 78(2):95–99.
8. Mohidin N, Hoon NL, Ishak B, Mohd Ali B(2014). Cornea endothelial cell morphology in short term silicone hydrogel soft contact lens wearers - Asian context. *IJCRIMPH*; 6:296–302.
9. Hamano H, Jacob JT, Senft CJ, et al(2002). Differences in contact lens-induced responses in the corneas of Asian and non-Asian subjects. *Clao J*; 28(2):101–104.
10. Doughty MJ(2014). A prospective analysis of corneal endothelial polymegethism and cell density in young adult Asians. *Clin Exp Optom*; 97(3):256–263.
11. Magdum RM, Mutha N, Maheshgauri R(2013). A study of corneal endothelial changes in soft contact lens wearers using non-contact specular microscopy. Med J DY Patil Univ; 6:245-9.
12. Yildiz, Y., Gurdal, C., Sarac, O., Nacaroglu, S. A., Takmaz, T., & Can, İ. (2012). The long-term effects of silicone hydrogel contact lens wear on corneal morphology/Silikon hidrojel kontakt lens kullaniminin kornea morfolojisi uzerindeki uzun donem etkileri. Turkish Journal of Ophthalmology, 42(2), 91-97.
13. Setälä K, Vasara K, Vesti E, Ruusuvaara P(1998). Effects of long-term contact lens wear on the corneal endothelium. *Acta Ophthalmol Scand*; 76(3):299–303.
14. Jones L(1988). The use of high water content lenses on a daily wear basis. *J Brit Contact Lens Assoc (Scientific Meeting)*: 26–31.
15. La Hood D(1991). Daytime edema levels with plus powered low and high water content hydrogel contact lenses. *Optom Vis Sci*; 68(11):877–880.