IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 3 Ser.14 (March. 2020), PP 28-35
www.iosrjournals.org

The Corneal Endothelial Changes in Soft Contact Lens Wearers Using Non-Contact Specular Microscopy

Basimah SalehAlotaibi[1], Alhanouf Abdullah Alkhalaf[2]
[1]*Department of Optometry, Collage of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia*
[2]*Department of Optometry, Collage of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia*

Abstract:
Background*: The main features of change of the size of the cells of the corneal endothelium explained with a particular emphasis placed a raw pointer of early morphologic changes of the corneal endothelium. Purpose: Study the influence on the morphologic properties of the corneal endothelium in soft contact lenses wearers by specular microscopy.*
Materials and Methods*: This prospective cross-sectional study included an entire of sixty-four females students enrolled in the study from the College of Applied Medical Science. An age (19-31 years) matching control group (33 female subjects) with a mean age of (21.48±2.26 years) participated in the study who are never wearing contact lenses . And a total of (31 female subjects) that ranged in age from 19 to 32 years with an average age of 20.97± 2.76 years with no past of corneal dysfunctions, and they employ soft contact lenses for more than one year . Each participant accomplished the baseline ophthalmic examinations, including best-corrected visual acuity (BCVA) assessment, refractive measurements, and then asked for a non-contact specular microscopy instrument.*
Results*: There was no significant difference in cell density (CD) and the corneal thickness (CT) between the control group and soft contact lenses wearers group. At the same time, there was a significant difference in Polymegethism (CV) and Pleomorphism (HEX), P<0.05between the groups.There was a weak positive relationship between refractive error status and cell density (CD), with a meaningful difference (p<0.05), As the refractive error increased the cell density of corneal endothelium increased (r=0.2246, P<0.05).*
Conclusion: *The use of soft contact lenses induced considerable morphological changes in the corneal endothelium. Contact lenses wearers showed more significant variations in Polymegathism (CV), and Pleomorphism(HEX) compared to non-contact lens wearers.*
Key Word*:Corneal Endothelial Changes, Specular Microscopy, Soft Contact Lenses Wearers*

Date of Submission: 12-03-2020 Date of Acceptance: 27-03-2020

I. Introduction

Cornea

The corneal endothelium contains a particular layer of flat hexagonal cells in a mosaic shape. It manages corneal hydration and is permeable to oxygen and other nutrients from the aqueous humor. Contact lenses are little, delicate, plastic disks designed to lie on the cornea to correct refractive errors. However, wearing contact lenses includes routinely insertion of a foreign body on the cornea, which may be in the lead altered anatomy and physiology.[1]

Extended lens wear may produce corneal hypoxia resulting in fluid buildup in the stroma. Numerous researchers have shown morphologic alterations in the corneal endothelial cells of wearers of many kinds of contact lenses. Such changes may be revealing of cell stress due to constant hypoxia, which runs to lactate accumulation, raised carbon dioxide levels, and PH changes.[2]

Pleomorphism and Polymegathism may be subtle and could lead to changes in the health of corneal and being indicative of altered cell function. Hence, the functional ability of corneal endothelium may be related to its morphologic appearance.[3]

Contact Lens and Endotheliopathy

With approximated numbers of contact lens wearers universal beyond 140 million, even complications with a low occurrence will assume a significant amount of individuals. Although contact lenses have numerous advantages for wearers, some risks have related to their use. Differences in danger for different types of contact lenses and wearing patterns have explained for both infrequent and common lens-related complications.[4]

However, prolonged wear of lenses can produce many compactions, such as hypoxia and lens deposits. Particular patients lean to deposit proteins and lipids on the lens surface every day wear and at a higher incidence during prolonged wear. Accumulation of these puts can be related to reduced vision.[5]

Rate of Polymegethism

The full coverage of the posterior corneal surface is required to argue the barrier function and the active transport mechanism of the corneal endothelium. Because of normal attrition, the central cornea misplaces 100 to 500 endothelial cells annually. When these cells die, they slough off the posterior surface of the cornea into the anterior chamber, making a gap in the endothelial mosaic that compromises both the barrier and pump purposes of the endothelium.

The endothelial cells are trying to the flaw attempt to pack in the space left by the sloughed cell. The endothelial cells either stretch or slide into a different position; they fuse to re-establish complete coverage of the posterior surface of the cornea. This advance of the endothelial cells develops dissimilarity in the cell dimension known as Polymegethism.

Because Polymegethism is a consideration of the healthy endothelial cell movement that characterizes the wound repair mechanism, there is always some degree of Polymegethism in the corneal endothelium. The rate of Polymegethismmeant by, the coefficient of variation (CV). CV values measured between 0.22 and 0.31 are reflecting normal.[6]

Presence of Pleomorphism

Pleomorphism is considering a break in the regular hexagonal pattern of the endothelium that causes a decrease in endothelial mosaic stability. Pleomorphism occurs secondary to physiological stress from ocular disease, contact lens wear, or regular aging changes.

If a patient's corneal endothelium demonstrates less than 50% hexagonally-shaped cells, he or she is considered to have clinically significant Pleomorphism. This will have a critical effect on the fluid barrier function of the endothelium; the presence of Pleomorphism increases the patient's risk of developing iatrogenic corneal endotheliopathy and postoperative corneal edema.[7]

This study aims to examine and determine the effect of the morphologic characteristics in the corneal endothelium for soft contact lens wearers by non-contact specular microscopy, and to measure the central corneal thickness, corneal endothelial alterations.

II. Material And Methods

This observational, cross-sectional prospective study comprised an entire of sixty-four females students enrolled in the study from the College of Applied Medical Science. An age (19-31 years) matching control group (33 female subjects) with a mean age of (21.48±2.26 years) participated in the study who are never wearing contact lenses . And a total of (31 female subjects) that ranged in age from 19 to 32 years with a mean age of 20.97± 2.76 years with no history of corneal dysfunctions, and they benefit soft contact lenses (daily or prolonged wearers) for more than one year . Informed written permission obtained from each member before leading the study.The study accepted by the ethics group of the College of Applied Medical Science and the participants were treated based on the Helsinki Declaration.

Study Design: observational, cross-sectional prospective study

Study Location: This study done in Department of Optometry, at College of Applied Medical Science, King Saud University, Saudi Arabia, Riyadh.

Study Duration: January 2019 to April 2019.

Sample size: 64 patients.

Sample size calculation: The sample size estimated on the basis of a single proportion design. We assumed that the confidence interval of 10% and confidence level of 95%. We planned to include 64 patients (Group I- Control cases of 33 patients those are never wearing contact lenses , Group II- Cases of 31 patients those are benefit soft contact lenses (daily or prolonged wearers) for more than one year.

Subjects & selection method: The study population drawn from females students at the collage of Applied Medical Science from January 2019 to April 2019. Participants were divided into two groups as follows:

Group 1(N=33 patients) - never wearing contact lenses;

Group 2 (N=31 patients) -those are benefit soft contact lenses (daily or prolonged wearers) for more than one year.

Inclusion criteria:
1. Females sex
2. Aged ≥ 19 years

Exclusion criteria:
1. Pregnant women
2. Rigid gas permeable (RGP) lens users
3. Cases with any corneal disease , endothelial dystrophies or dry eyes

Procedure methodology

After written informed consent was obtained, Comprehensive baseline ophthalmic investigations presented in all subjects, including best-corrected visual acuity (BCVA) assessment, refractive measurements. All types of refractive errors were enrolled and then invited for a non-contact specular microscopy instrument.

Data from each subject collected using, type of contact lens, number of years worn, and hours of daily wear.

Corneal endothelial morphology can be deliberate with different instruments, including contact specular microscopes, non-contact specular microscopes, and confocal microscopes. With developments in technology, modern forms of the wide field specular microscopes are non-contact; they are more patient-friendly and can attain equally high magnification. The non-contact specular microscope has extensively used in researches of corneal endothelial cell changes after contact lens wear. Non-contact specular microscopy includes all the needs for endothelial cell analysis and pachymetry with reliable, easy to use functions and a broad range of options.

Subjects advised adjusting their head and chain to an instrument and blink to wet the cornea and then to hold still just before image capture improves image sharpness. Non-contact specular microscopes use internal fixation points to deliver a more standardized approach to consistently imaging the central endothelium, mid-periphery, and periphery. The underlying construct in the software will provide minimum, maximum, and average cell size, cell density (CD), standard deviation, coefficient of value, and hexagonal cell ratio.

Figure no.1 Specular Microscopy

Statistical analysis

The analysis carried out using a statistical package performed by Excel (version 2010). We compared the parameters describing morphology between the contact lens wearers and the control groups using an analysis of an unpaired t-test. Pearson's correlation and linear regression used to examine the relation between duration of soft contact lenses wear & kind of refractive error in the alterations of corneal endothelium & Central Corneal thickness CCT.

III. Result

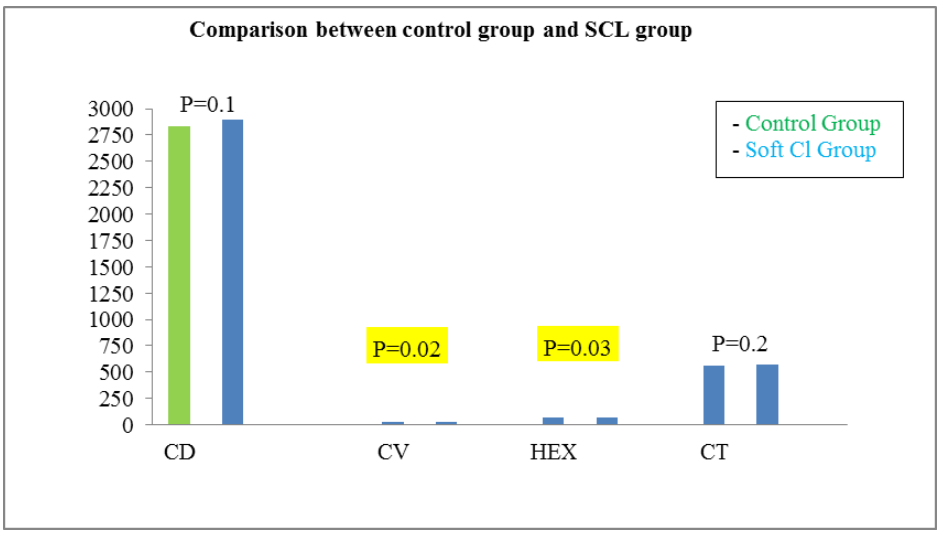
The study included 64 patients, a total of 128 eyes (33 Control subjects, (66 eyes); 31 Soft CL wearers (62 eyes)), all patients were female students. The mean age in the control group was 21.48±2.26, and 20.97± 2.76 years in the Soft CL group, the age range was 19-31. Descriptive statistics calculated for all study variables shown in Table no 1.

Table no 1

	Control	Soft CL wearers
Number of eyes	66	62
Number of Subjects	33	31
Age (yrs) mean ± SD	21.48 ± 2.26	20.97± 2.76
Age Range (min/max)	19-32	
Spherical Equivalent , mean ± SD	-0.36±1.52	-3.1±2.5
Cell Density (CD) , mean ± SD	2827.84±220.16	2891.22±243.32
Polymegethism (CV) , mean ± SD	25.6±3.45	28.14±8.28
Pleomorphism , (HEX) , mean ± SD	68.5±3.93	66.9±4.53
Corneal Thickness CT , mean ± SD	564.8±28.4	571.3±38.6
NUM of cell examined , mean ± SD	193.3±33.8	192.2±49.8
AVG , mean ± SD	355.7±28.02	348.7±30.2
No. of hours of daily wear, mean ± SD	0	9.32±5.35
No. of years worn , mean ± SD	0	4.45±2.15

Corneal Endothelial Changes in control group and SCL wearers

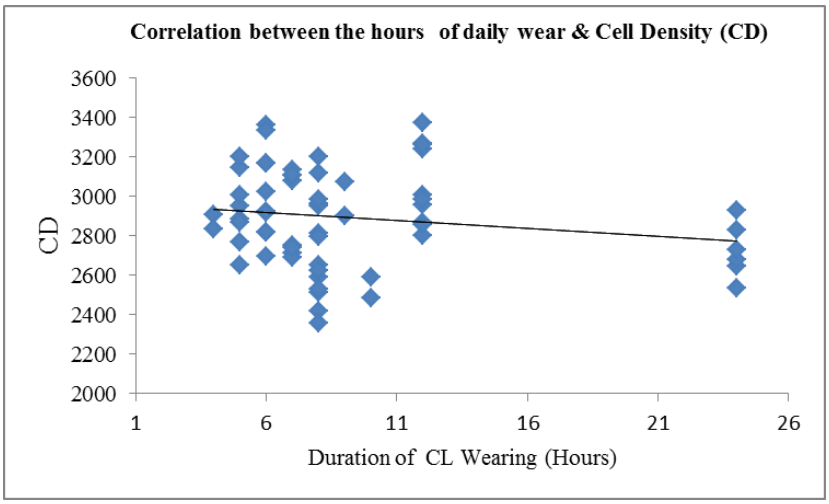
A diagram of corneal endothelial changes illustrated in figure no.1 below; there was no significant difference in cell density (CD) & corneal thickness (CT) between control groups and SCL groups. On the contrary, there was a substantial difference between Polymegethism (CV) (*P*=0.02) and Pleomorphism (HEX) (*P*=0.03) between the groups.



The Duration and Parameters of Corneal Endothelial Changes of soft contact lens group (SCL)

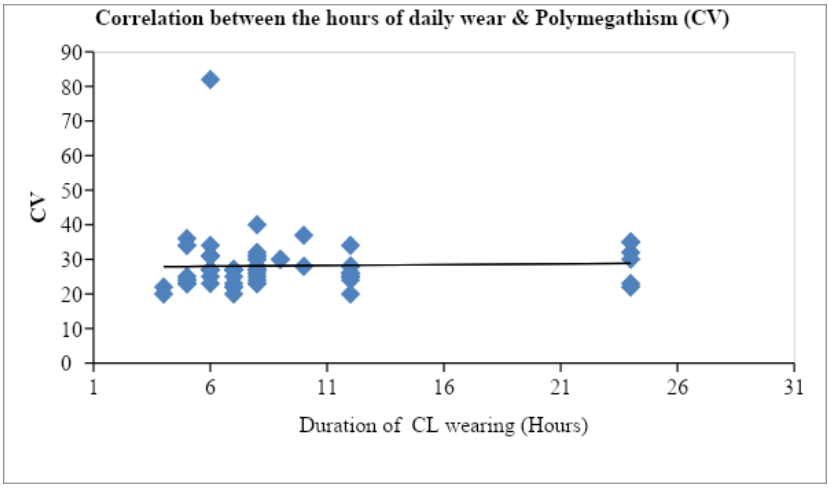
The Cell Density egnahC

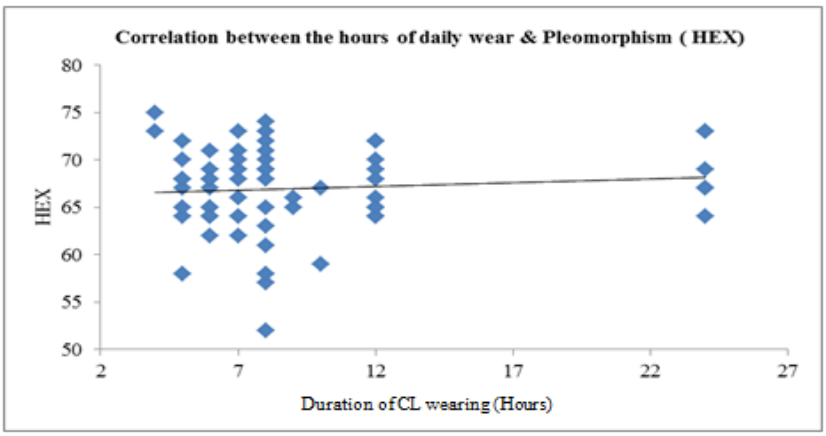
Figure no.2 below did not show any significant correlation even it seemed to be inverse (r=-0.1769). Cell Density decrease as the number of hours every day of contact lenses wears rises. This difference used to verify statistical significance (P<0.05).

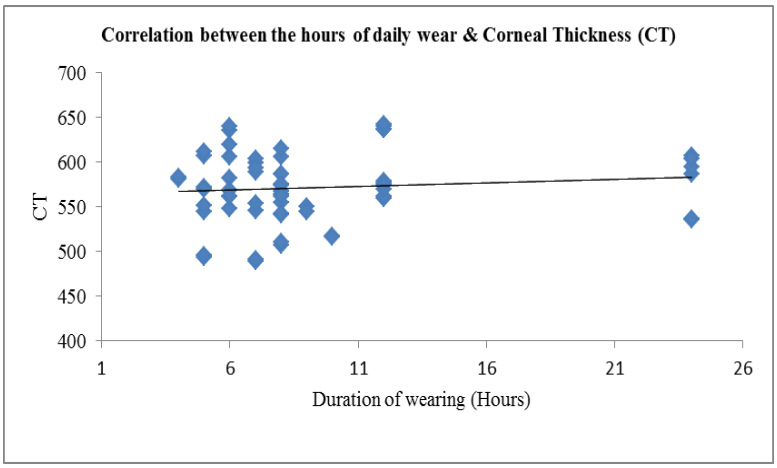


Polymegathism ,Pleomorphism and Corneal Thickness Changes

Figures no 3 , 4 & 5 below appear to be a positive association but very weak that reveals no relation related to the number of hours of daily wear and Polymegathism (CV), Pleomorphism (HEX) & Corneal Thickness (CT). When all gather contrasted, the difference in mean was statistically significant (P<0.05).



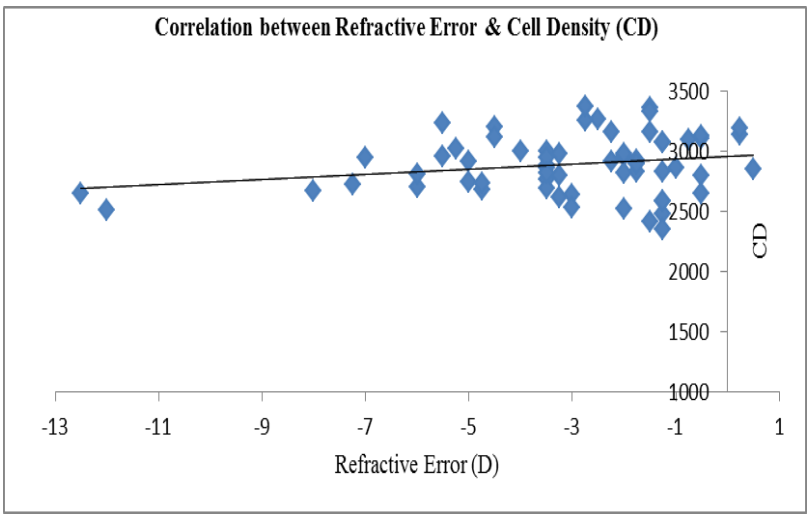


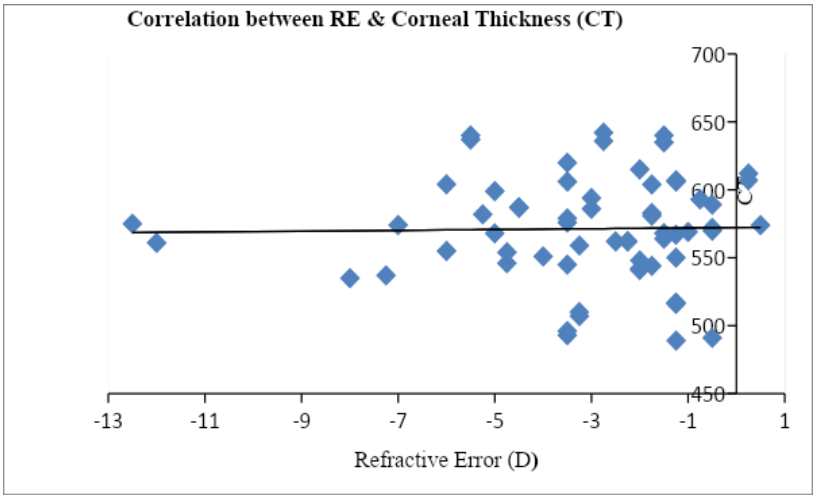


The Refractive Error Status and Parameters of Corneal Endothelial Changes of soft contact lenses group (SCL)

The Cell Density and Corneal Thickness Cegnah

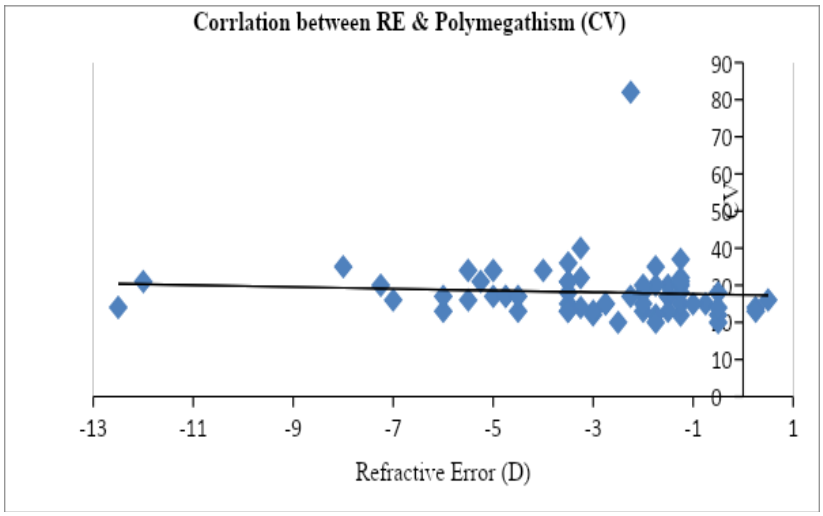
Figures no 6&7 below showed that There was a weak positive relationship between refractive error status and Cell Density (CD), Corneal Thickness (CT) , As the refractive error increase the cell density of corneal endothelium increase (r=0.2246, P<0.05), (r=0.01981, P<0.05) respectively . Statistically, there were alters in the cell density and the corneal thickness. Statically, these attain meaningful differences (P<0.05).

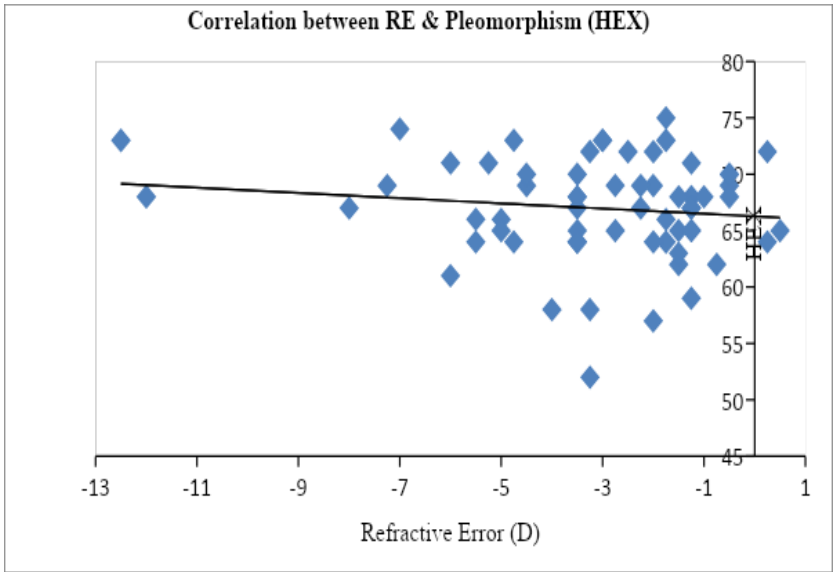




Polymegathism and PleomorphismegnahC

Figures no 8&9 below showed that there was a weak inverse relationship between refractive error and Polymegathism (CV) (r=-0.07219, P<0.05), between refractive error and Pleomorphism (HEX) (r=-0.1292, P<0.05). Statically, these attain significant differences (P<0.05).





IV. Discussion

This study aims to assess framework investigations for corneal endothelial morphological changes in the soft contact lens wearers.

This clinic-based study proved that there were changes in central corneal thickness (CCT) between the SCL group and the control group, but the difference did not reach significance (P=0.2). This result is in contrast with the previous study reported by Magdum, Maheshgauri&Mutha, and the mean CCT of the lens-wearing group was more than that of the control group if contact lens wearers and controls grouped, very highly significant (P<0.0001) correlation found between the CCT changes and lens use.[2]

This argument is consistent with the findings of Carlson et al, who found no difference in the CCT between contact lens wearers and controls. Nieuwendaal et al, reported similar results had obtained as well.[8, 9]

In our study, there was no significant difference in cell density (CD) between the SCL group and the control group (P=0.1). These findings agree with those studies done by Holden et al, in which no effect found of long term soft contact lens wear on the endothelium cell density ECD. While in a study done by Magdum, Maheshgauri&Mutha, they found that the mean cell density was less in the soft lens-wearing group than seen in the control group if contact lens wearers and controls grouped, highly significant (P<0.01) correlation found between the variation in ECD and lens use.[2, 10]

The difference in endothelial cellular hexagonality between soft contact lenses (SCL) group and control group in our study was significant HEX (P=0.03). This study supports the hypothesis that the numbers of hexagonal cells generally downgraded to about 50-60% of the endothelial mosaic, and they also tend to deviate from the typical hexagonal pattern. The findings in this study agree with the previous outcome reported by Ventocilla et al .[11]

Regarding the coefficient of variation in endothelial cell size, Rochester reported that there was a significant difference in the ratio of variety of cell size of the contact lenses group compared to the control group (P< 0.0001); this is consistent with the finding of this study as well.

This study set out to explore the effect of duration of contact lenses wear on the corneal endothelium. When the parameters were compared by correlation analysis with the length of lens wear in years and hours per day separately, we observed that a significant correlation found. This finding disagrees with the investigations of Carlson et al , while Lee et al, reported similar observations in their experiments that found that all soft contact lenses subgroups had a significantly higher coefficient of variation in cell size than non-contact lens users. The proportion of hexagonal cells and the mean corneal endothelial density in those using lenses were markedly lower than in the control group.[2, 8, 12]

Chang did a study, showed that the percentage of hexagonal cells decreased with both cumulative hours of contact lenses wear every day ($r = –0.36$, $P < 0.001$) and the duration of contact lens per year ($r = –0.33$, $P < 0.001$)[13]. This study differs from what found a weak positive relationship between the number of hours of daily wear and the Pleomorphism (HEX) ($r=0.11$, $P<0.05$) and. Also, our study showed that there was a negative, weak relationship between the number of years worn and Pleomorphism(HEX) ($r=-0.022$) Statistically, there are significant differences ($P<0.05$).

However, in summary, this work offers minimal aspects, such as the small sample size of both control and soft contact lenses wear groups, this is because of the few numbers of soft contact lens wearers in the college of applied medical sciences. Furthermore, this works also limited by its consideration of no ability to gather Male participants inside the Females Collage.

V. Conclusion

The usage of soft contact lenses induced significant morphological changes in the corneal endothelium. Contact lenses wearers showed more substantial variation in Polymegathism (CV) and Pleomorphism (HEX) compared to non-contact lens wearers.

References

[1]. Mannis, M. (2004). The History of Contact Lenses, Vol I: Early Neutralizations of the Corneal Dioptric Power. Cornea, 23(4), 424. doi: 10.1097/00003226-200405000-00026program (NCEP) expert panel on detection, evaluation, and treatment of highblood cholesterol in adults (adult treatment panel III) finalreport. Circulation. 2002;106(25, article 3143)

[2]. Magdum, R., Maheshgauri, R., &Mutha, N. (2013). A study of corneal endothelial changes in soft contact lens wearers using non-contact specular microscopy. Medical Journal Of Dr. D.Y. Patil University, 6(3), 245. doi: 10.4103/0975-2870.114645

[3]. Bourne, William M. "Morphologic and Functional Evaluation of the Human Corneal Endothelium." Advances in Corneal Research, 1997, pp. 273–278., doi:10.1007/978-1-4615-5389-2_26

[4]. Jansen, M., Wagner, H., Kinoshita, B., Mitchell, G., Chalmers, R., Richdale, K., & Lam, D. (2012). Survey of previously established risk behaviors in young soft contact lens wearers. Contact Lens And Anterior Eye, 35, e1-e2. doi: 10.1016/j.clae.2012.08.005

[5]. Foulks, G. (2006). Prolonging Contact Lens Wear and Making Contact Lens Wear Safer. American Journal Of Ophthalmology, 141(2), 369-373.e2. doi: 10.1016/j.ajo.2005.08.047

[6]. OLSEN, T. (2009). Non-contact specular microscopy of human corneal endothelium. ActaOphthalmologica, 57(6), 986-998. doi: 10.1111/j.1755-3768.1979.tb00529.x

[7]. Pamela Ebert Flattau. (1991). Considerations in Contact Lens Use Under Adverse Conditions. National Academies Press

[8]. Carlson KH, Bourne WM, Brubaker RF. Effect of long‐term contact lens wear on corneal endothelial cell morphology and function. Invest Ophthalmol Vis Sci 1988;29:185‐93

[9]. Nieuwendaal CP, Odenthal MT, Kok JH, Venema HW, OostingJ,Riemslag XF, et al. Morphology and function of the cornealendothelium after long‐term contact lens wear. Invest Ophthalmol Vis Sci 1994;35:3071‐7.

[10]. Holden BA, Sweeney DF, Vannas A, Nilsson KT, Efron N. Effects of long‐term extended contact lens wear on the human cornea. Invest Ophthalmol Vis Sci 1985;26:1489‐501.

[11]. Ventocilla M. Chief Editor: Hampton Roy Sr. In: Ventocilla M, Roy H, Editors. Contact Lens Complications. Available from: http:// www.emedicine.medscape.com/article/1196459‐overview. [Lastupdated Oct 17,2012] [Last accessed on 2011 Mar 8].

[12]. Lee JS, Park WS, Lee SH, Oum BS, Cho BM. A comparative study of corneal endothelial changes induced by different durations of soft contact lens wear. Graefes Arch ClinExpOphthalmol 2001;239:1‐4.

[13]. Chang, S. (2001). The cornea in young myopic adults. British Journal Of Ophthalmology, 85(8), 916-920. doi: 10.1136/bjo.85.8.916