JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

COMPARISON OF CORNEAL SENSITIVITY BETWEEN DIFFERENT TYPES OF CONTACT LENS

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ABSTRACT

Aim and objective:

The aim of this study was to find out the corneal sensitivity between two different types of contact lenses, and non-contact lens wearers. The study was conducted experiments to detect whether sensitivity changes were also different for the different zones.

Method:

A prospective study was performed including 120 subjects, among which 40 subjects were soft hydrogel lens wearers and 40 were silicon hydrogel lens wearers and 40 subjects with no lens presenting at Dr. D.Y. Patil Institute of Optometry and Visual Sciences, Pune, from January 2022 to July 2022. Corneal sensitivity was measured using fine wisp of cotton and data analysis was done based on distribution.

Result:

Using a fine wisp of cotton time taken for response in the form of blinking is measured in seconds and found in meantime, for the non-contact lens wearer was 0.361, for silicone contact lens wearer is 0.415 and for the hydrogel contact lens wearer is 0.619 .Statistical analysis showed that all the experimental groups (non-contact lens users, silicone hydrogel lens wearer, hydrogel contact lens wearer) significantly differed in terms of corneal sensitivity from each other.

Conclusion:

The study can be concluded by saying that both hydrogel and silicone hydrogel contact lens produce a similar type of corneal sensitivity loss, The recovery of corneal sensitivity loss was achieved by cessation of contact lenses.

Key Words : Corneal Sensitivity, Hydrogel, Silicone Hydrogel, wisp of cotton.

Introduction:

The body's surface tissue with the most extensive innervation is the cornea. It receives the majority of its nerves, which are sensory, from the ciliary branches of the trigeminal nerve's ophthalmic division, which enters the cornea radially at the mid-stromal level and repeatedly divides as it passes superficially to contribute to a dense plexus of nerves right under Bowman's membrane. [1] One of the most sensitive organs in the body is the corneal epithelium, which has a significant number of nerve endings. The cornea has the highest concentration of free nerve endings in the body, which results in a high level of sensitivity to noxious stimuli. In identifying and avoiding injury to the cornea and anterior ocular surface, they are essential.[2]

The cornea, which is innervated by sensory nerve terminals that are functionally diverse, interacts with the contact lens.[5] The functional unit is made up of the ocular surface (cornea, conjunctiva, and meibomian glands), the lacrimal glands and the sensory and motor neurons that connect them receive sensory information from the cornea and conjunctiva. The afferent and efferent nerves form an intricate network that joins the parts of the integrated unit into a homeostatic loop, which has the main goal of preserving the ocular surface's health. Moreover, corneal sensory nerves have different trophic effects on the cornea, which may influence how wound healing after corneal injury is modulated.[8]

In this study, the corneal sensitivity of hydrogel Contact lens and silicon hydrogel contact lens was compared with non-contact lens wearer. Corneal sensitivity was measured with the help of a wisp of cotton.

One previous study found that both soft and RGP lens wear produce a similar type of corneal sensitivity loss, although the mechanism for this loss is different for the two lens types.[9] Another study found that as the time of wear increases, both in the short-term (days) and long-term (months), the greater the loss of sensation.[10] Another Study found that corneal sensitivity decreased in both who wore lenses contained 38% and who wore lenses contained 55% during the first 8 h following insertion, the decrease was more marked in the group who wore 38% water lenses.[11]

Methodology:

It was a prospective study done at Dr. D.Y.Patil Institute of Optometry and Visual Science, Pune from October 2022 to February 2023. Institutional sub-ethical clearance was taken before starting the study. Informed consent was signed by all the participants. Subjects with any ocular pathology were excluded from the study. Age groups 18 or more and willing to participate in the study were included.

Total 120 subjects were recruited in this study among them 40 subjects were non-contact lens users, 80 were contact lens users. Subjects were approached in such a way that the thin cotton wisp was out of the subjects' field of vision. While the participant was looking down, the superior corneal zone (SCZ) of the eye was first measured. The participant was asked to look up while we measured the inferior corneal zone (ICZ). The central corneal zone (CCZ) was assessed while the subject was facing straight ahead, while the nasal (NCZ) and temporal (TCZ) corneal zones were measured with the subject gazing outward and inward, respectively. A stopwatch is used to record the subject's blinking time in seconds.

There were variances in the sensitivity of the right and left eyes, and these variations can be attributed to the fact that the right eye was assessed first. The left eye experienced some additional

fatigue as a result of this. Thus, only changes in sensitivity in the right eye will be taken into account in this investigation.

Statistical Analysis:

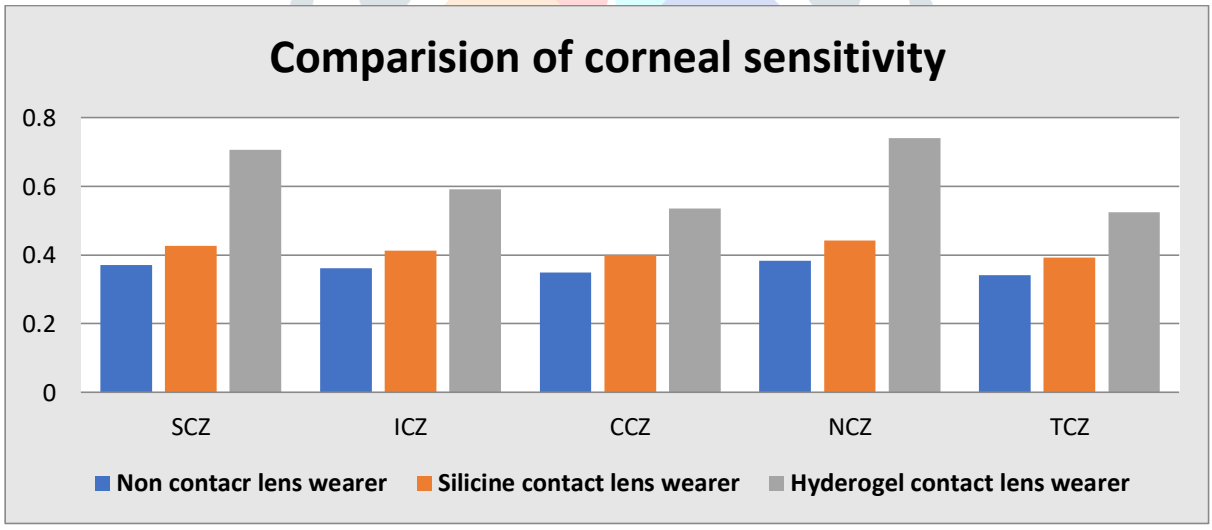
Data was entered in Microsoft Excel 2019 (Part of Microsoft Office Professional Edition) [computer program]. Microsoft; 2019) and analyzed using MedCalc v18.2.1 (MedCalc Statistical Software version 18.2.1 (MedCalc Software, Ostend, Belgium; http://www.medcalc.org; 2018).

Categorical variables were summarized using number (N) & percentages (%) and 95% confidence limits (where applicable), continuous variables expressed as mean and SD & Median and IQR (where applicable). Normal distribution was verified by Shapiro-Wilk test. Kruskal-Wallis test was used to check for significance of observations between multiple groups. In all the tests performed, $P < 0.05$ was considered to be statistically significant.

RESULT:

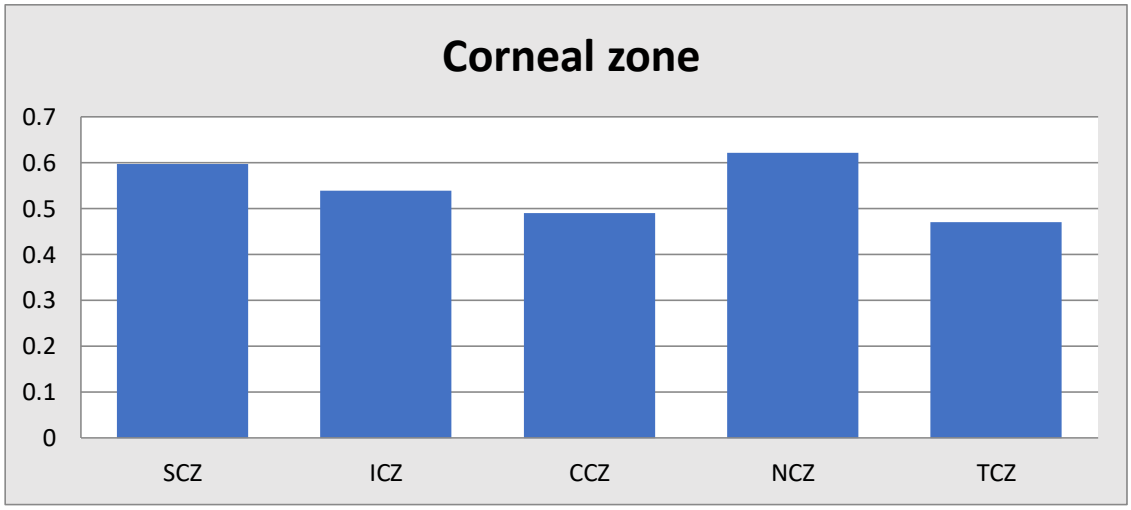
Total 120 subjects were recruited in this study among them 40 subjects were non-contact lens users and 80 were contact lens wearers.

The percentage analysis shows the ratio of Males and females of which 61 (50.8%) were Male and 59 (49.1%) were Female. The statistically analyzed 95% CI for males is 39.81 to 62.59 and for females is 37.41 to 60.19. The ratio of age of which 44 (55%) subjects were from 18 to 30 years and 36 (45%) more than 30 years old. The percentage analysis shows 40 (33.3%) were non-contact lens wearers, 40 (33.3%) were silicone contact lens wearers, 40 (33.3%) were hyderogel contact lens wearer. Statistical analysis shows 95% CI of 40 non-contact lens users is 15.99 to 35.94 and 95% CI of 80 contact lens wearers is 64.06 to 84.01



Graph 1: Comparison of corneal sensitivity (response in terms of blink time in seconds) with non-contact lens wearer and different type of contact lens wearers

Graph shows, among 40 non contact lens wearer mean blink response time in seconds at superior corneal zone is 0.371, at Inferior corneal zone is 0.362, at central corneal zone is 0.349, at Nasal corneal zone is 0.384 and at Temporal corneal zone is 0.341,among 40 silicone contact lens wearer mean blink response time in seconds at superior corneal zone is 0.426, at Inferior corneal zone is 0.413, at central corneal zone is 0.401, at Nasal corneal zone is 0.442 and at Temporal corneal zone is 0.393 .Among 40 Hyderogel contact lens wearer mean blink response time in seconds at superior corneal zone is 0.706, at Inferior corneal zone is 0.591, at central corneal zone is 0.535, at Nasal corneal zone is 0.741 and at Temporal corneal zone is 0.525.



Graph 2: Comparison of Corneal Sensitivity in different corneal zone

The graph shows, the highest corneal sensitivity loss is at the nasal corneal zone and the lowest is at the central and temporal corneal zone. The corneal sensitivity mean value in seconds for NCZ is 0.623, SCZ is 0.598, ICZ is 0.539, CCZ is 0.49 and for TCZ is 0.471

Statistical analysis:

Based on analysis of the Kruskal-Wallis test it can be concluded that there was a significant difference in all five corneal zone between contact lens wearers and non-contact lens users.

Table 1: Shows the result of Krushkal wallis test

Corneal Zone	**H statistic (degree of freedom)**	**P value**
SCZ	67.39 (2)	<0.001
ICZ	67.89 (2)	<0.001
CCZ	68.06 (2)	<0.001
NCZ	66.95 (2)	<0.001
TCZ	69.39 (2)	<0.001

Post-statistical analysis showed that all the experimental groups (non contact lens users, silicone hydrogel lens wearer, hydrogel contact lens wearer) significantly differed in terms of corneal sensitivity from each other.

Discussion:

The main aim of this study was to elucidate how different types of contact lens affect the corneal surface in terms of sensitivity. The sensitivity loss was found to be affected. Additionally, this study conducted tests to see if changes in sensitivity were also varied for the various corneal zones as it is known that the number of nerve endings in the cornea varies for each zone.

Paul J. Murphy, Sudi Patel et al in their study concluded that a significant reduction in corneal sensitivity was found between the contact lens wearers and non-lens wearers (p =0.000), no difference was found between the two lens-type subgroups (p= 0.939).[9]

In this study, with fine wisp of cotton time taken for response in form of blinking is measured in seconds and found all the experimental groups (non contact lens users, silicone hydrogel lens wearer, hydrogel contact lens wearer) significantly differed in terms of corneal sensitivity from each other.

According to the findings of this study, the central and temporal zones are less sensitive. These findings are consistent with the location of surface nerve terminals on the corneal epithelium. Corneal innervations density was shown by Rozsa & Beverman (1982) to decrease from the apex of eye to its periphery.[11]

Earlier studies have revealed that altered metabolic activity, caused by a decreased oxygen and carbon dioxide gaseous exchange, is the primary cause of diminished corneal nerve function. Contact lens wearers gain from decreased corneal nerve function in the form of improved ocular comfort.[12] It's possible that increasing oxygen delivery and reducing carbon dioxide from the anterior corneal surface while wearing contacts will reduce comfort levels, possibly even to the point where contacts are painful to wear. If this is the case, then wearing RGP lenses should have a less significant impact than wearing soft lenses because the degree of gaseous exchange is higher with RGP lenses due to the combined effects of lens material and tear exchange.

The entire corneal surface is covered by soft lenses, which means that both the centre and the periphery of the cornea are impacted by the changed metabolic function. Wearers of RGP lenses do not experience any impairment in metabolic activity since the peripheral cornea is not covered by the lens in these cases. However, it is more exposed to the mechanical action of the lens edges during blinking and this causes peripheral corneal sensitivity loss.

As the eye relies on the corneal nerves to identify foreign things that could damage the ocular surface, a lower corneal sensitivity could be harmful to the cornea's long-term health. Contrarily, while the comfort of wearing contacts is enhanced by a decrease in corneal sensitivity, there is a corresponding rise in the possibility of an undetected foreign body on the ocular surface. It is possible for the harmful particle to get trapped under the lens, extending the time that it may cause eye irritation. Because of this, it's crucial that contact lens use have as little of an impact as possible on corneal nerve function.[9]

Contact lens removal can restore corneal sensitivity; however it depends on the type and quantity worn. After wearing soft contact lenses, sensitivity typically returns more quickly than with hard lenses.

Conclusion:

The study can be concluded by saying both soft hydrogel and RGP lens wearer produced similar type of corneal sensitivity loss, although the mechanism for this loss is different for the two lens types. The recovery of corneal sensitivity loss is achieved by cessation of contact lens. This review has demonstrated the usefulness of assessing corneal sensitivity as a measure of corneal health with contact lens wear. This study was done manually assessing the time period. The limitation of this study can be overcome by the availability of an aesthesiometer for more precise reading.

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