Color soft contact lens and corneal thickness

Douk-Hoon Kim*

Department of Optometry, Masan University
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Abstract

Purpose: To investigate the effect of color soft contact lenses on the corneal thickness in young Korean population.

Methods: The subjects consisted of 112 eyes (7 males, 49 females) with the mean age of 20.987±1.093 years (range 20-25 years) in young Korean population during 2018. Test was compared the corneal thickness before and after wearing color soft contact lenses. The thinnest cornea thickness(TCT), central cornea thickness(CCT), pupil centre thickness(PCT), superior corneal thickness(SCT),inferior corneal thickness(ICT), medial corneal thickness(MCT), lateral corneal thickness(LCT) of the cornea was measured using the Pentacam pachymetry. The statistically analysis was perform the Shaparo-Wilk test.

Results: The right eye was a statistically significant among the CCT,LCT, MCT and TCT values($p<0.001$) in the compared the corneal thickness before and after wearing soft colour contact lenses. Also the left eye was a statistically significant among the LCT and MCT values($p<0.001$) in the compared the corneal thickness before and after wearing soft colour contact lenses. However, there was no statistical difference ($p>0.5$) in the mean PCT between before and after wearing color soft contact lenses.

Conclusion: These results suggested that the color soft contact lens wear can the effect the regional thickness of cornea. Therefore, the analysis of corneal topography with Pentacam can provide correct and useful diagnostic information of the morphology of the RGP contact lens fitting and diagnosis of corneal refraction surgery.

Key words: Corneal topography, CCT, PCT, Pentacam, TCT

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*Corresponding author : doukhoon@naver.com

1. Introduction

The corneal analysis with Pentacam system is based on the Scheimpflug imaging principle. A 360° rotating measurement probe is used to scan the anterior segment of the eye for simultaneous acquisition of corneal thickness at any point, as well as the corneal apex and corneal pupillary center. In addition, the Pentacam system can quantitatively analyze the regular and irregular astigmatism in the cornea. The method also has the advantages of high data accuracy, good repeatability, non-contact, short examination time, and easy acceptance by the subjects [1-3].

Therefore, the data acquired by topography tools has suggested significant important information in clinical diagnosis and management of keratoconus suspects[4], contact lens wear[5], and keratoplasty [6]. Corneal thickness of each region is an indicator of corneal hydration and metabolism[7].

On the other hand, the topographic results of the central corneal thickness have been used to the assessment of daily disposable contact lenses[8] and intraocular pressure[9]. Distribution of the central and paracentral corneal thickness and curvature has been studied in the European population[10]. Recently, the rigid gas permeable contact lens and corneal topography has been studied through the pachymetry system[10].

In this study, we research characteristics of the central, apex, thinnest corneal thickness and peripheral corneal thickness in young Korean population by using pachymetry data obtained from the Pentacam system. The purpose of our study was therefore to analysis the effect of color soft contact lenses on the corneal thickness in young Korean population .

2. Materials and Methods

2.1. Subjects

This study included 112 eyes of fifty two subjects in young Korean populations. They have no ocular disease, medication, systemic disease, contact lens wear, and refractive surgery. The subject's age ranged from 20 to 25 years. To exclude ocular disease, we tested the visual acuity, IOP, slit-lamp, and visual filed .

2.2 Examination

The corneal thickness at a distance of 5mm from central cornea were obtained by measurements of the Pentacam topography system (Bausch & Lomb, USA). The measurements were obtained for each eye. The Pachymetry was used for corneal topography measurements while the subjects were silently seated in a test room. The subjects were asked to keep both eyes open and focus on a light source in the center of the scan field. The measurements automatically operated when the correct alignment and focus of eye were achieved. The thicknesses at the thinnest area, apex zone, pupil center and peripheral zone of cornea were recorded automatically and analyzed by a SPSS 12 and a micro-soft excel program. All measurements were made from 10:00 A.M. to 12:00 A.M. During the test, the temperature ranged from 18° to $21^{o}C$, and the humidity ranged from 40% to 50%. Only the scans with the quality factor of 95% or more were selected for the analysis.

2.3 Data analysis

Analyses were performed by using SPSS 12 software. Descriptive data were expressed as mean±standard deviation. The Sharpiro-Wilk

-test was analysis the corneal thickness before and after wearing color soft contact lenses in the several zone of cornea. P values of less than 0.05 was considered as statistically significant.

We acquired the corneal topographic data from 122 eyes (49 females, 7 males) with the mean age of 20.987±1.093 years (range 20-25 years) in young Korean population. The analysis of test of normality of corneal topography for these subjects were summarized in the table 1.

3. Results

Table.1. Test of normality of corneal topography

Eyes	Items	Sharpiro-Wilk	
		Z	P
Right eye	PCT	0.983	0.655
	TCT	0.893	<0.001
	CCT	0.986	0.769
	MCT	0.980	0.519
	SCT	0.978	0.432
	LCT	0.984	0.670
	ICT	0.989	0.902
Left eye	PCT	0.791	<0.001
	TCT	0.971	0.208
	CCT	0.886	<0.001
	MCT	0.982	0.590
	SCT	0.869	<0.001
	LCT	0.796	<0.001
	ICT	0.815	<0.001

The right eye was a statistically significant among the CCT,LCT, MCT and TCT values(p<0.001) in the compared the corneal thickness before and after wearing soft color contact lenses(Table 2, Figure 1-5). Also the left eye was a statistically significant among the LCT and MCT values(p<0.001) in the compared the corneal thickness before and after wearing soft color contact lenses(Table 2, Figure 6-7). However, there was no statistical difference (p>0.5) in the mean PCT between before and after wearing soft color contact lenses in the binocular (Table 2).

Table.2. Analysis of corneal topography before and after wear of color soft contact lenses in young Korean population

Eyes	Items	Before color soft contact wear		After color soft contact lenses wear		t/Z	p
		Mean	SD	Mean	SD		
Right eye	PCT	568.94	30.00	571.33	30.42	1.228	0.225
	TCT	560.15	29.44	561.85	35.75	2.319	0.020
	CCT	567.89	28.17	573.07	27.87	3.423	0.001
	MCT	590.20	28.39	594.61	28.12	2.606	0.012
	SCT	579.93	28.33	584.44	31.28	2.031	0.047
	LCT	564.19	29.13	568.39	27.94	2.062	0.044
	ICT	574.76	33.46	579.28	29.53	1.462	0.150
Left eye	PCT	566.13	30.31	572.74	47.45	-1.679	0.093
	TCT	557.63	30.41	561.37	33.14	1.671	0.101
	CCT	567.83	29.23	570.65	39.56	-0.606	0.545
	MCT	590.57	31.75	589.61	37.44	-0.289	0.773
	SCT	580.04	32.06	585.87	41.85	-1.397	0.162
	LCT	560.44	30.43	569.5	46.46	-2.109	0.035
	ICT	570.72	28.98	575.76	44.69	-2.515	0.012

TCT: thinnest area of cornea, CCT: central area of cornea, PCT: pupil area of cornea,
$p < 0.05^*$, $p < 0.01^{**}$

The mean thinnest cornea- thickness before and after wearing color soft contact lenses in the right eye was $560.15 \pm 29.44 \mu m$ and $561.85 \pm 35.75 \mu m$, respectively(Figure 1).
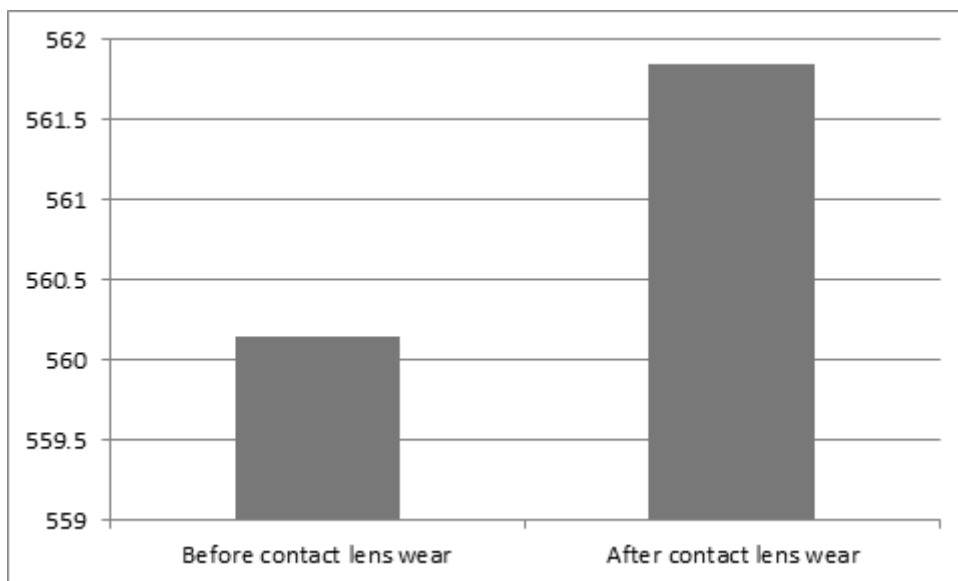

Figure 1. The mean of TCT in the right eye of a Korean subjects. P=0.020

The mean central cornea- thickness before and after wearing color soft contact lenses in the right eye was 567.89±28.17μm and 573.07± 27.87 μm, respectively(Figure 2).
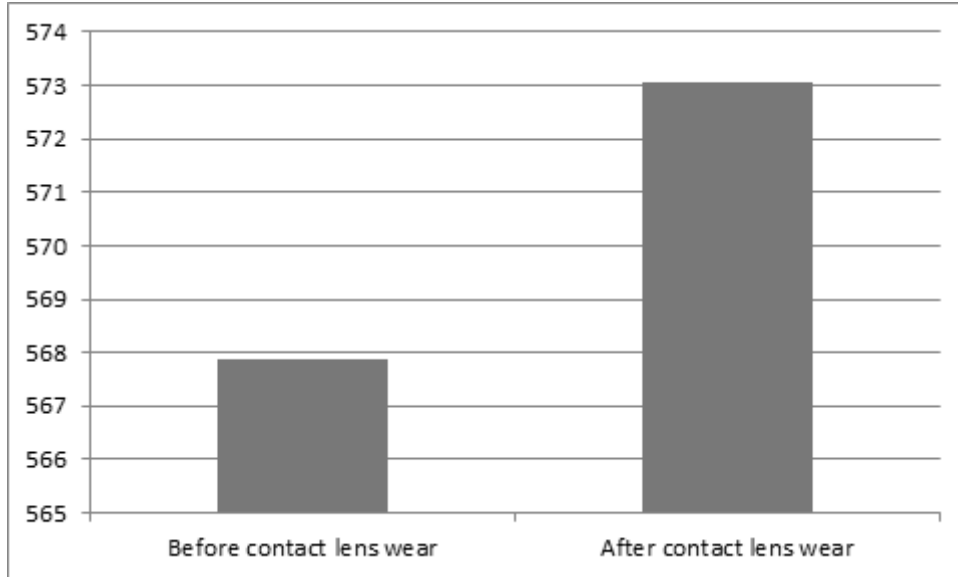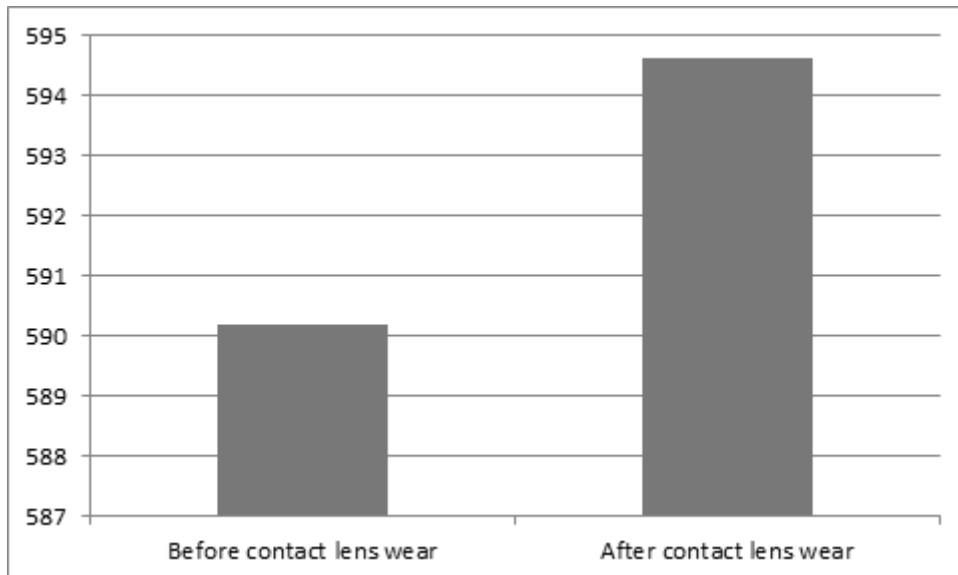

Figure 2. The mean of CCT in the right eye of a Korean subjects. P=0.001

The mean medial cornea- thickness before and after wearing color soft contact lenses in the right eye was 590.20±28.39μm and 594.61± 28.12 μm, respectively(Figure 3).

Figure 3. The mean of MCT in the right eye of a Korean subjects. P=0.012

The mean superior cornea- thickness before and after wearing color soft contact lenses in the right eye was $579.93 \pm 28.33 \mu m$ and $584.44 \pm 31.28 \mu m$, respectively(Figure 4).
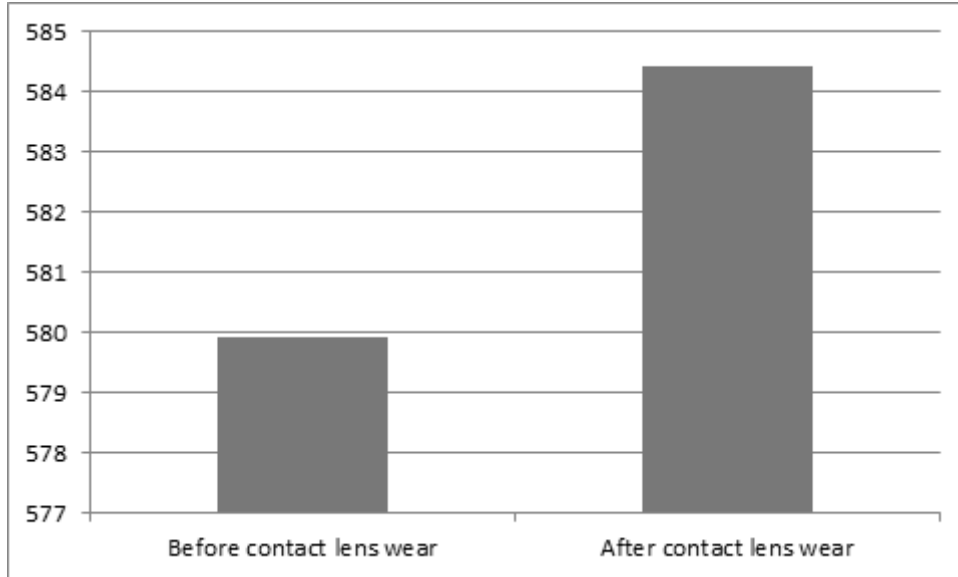

Figure 4. The mean of SCT in the right eye of a Korean subjects. P=0.047

The mean lateral cornea- thickness before and after wearing color soft contact lenses in the right eye was $564.19 \pm 29.14 \mu m$ and $568.39 \pm 27.94 \mu m$, respectively(Figure 5).
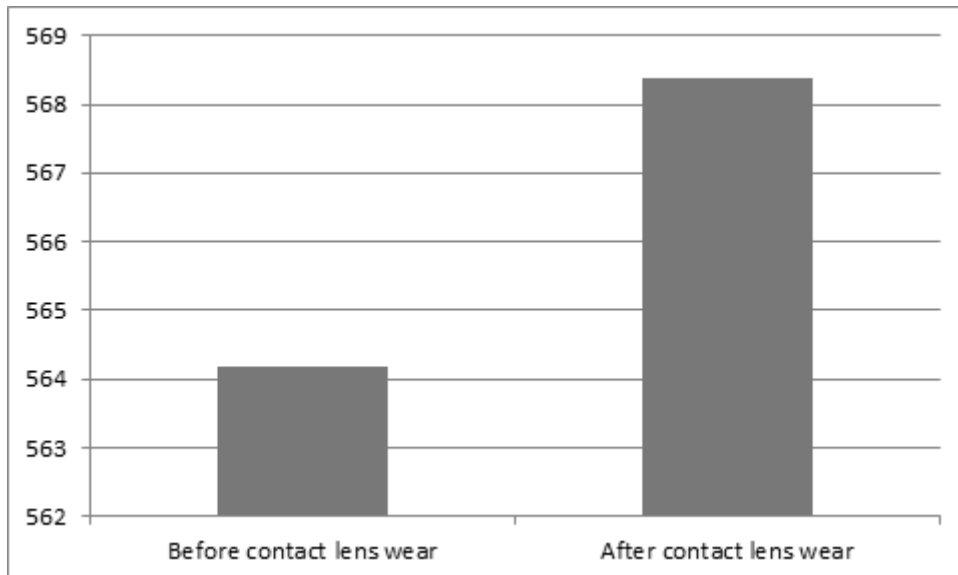

Figure 5. The mean of LCT in the right eye of a Korean subjects. P=0.044

On the other hand, the mean lateral cornea-thickness before and after wearing color soft contact lenses in the left eye was 560.44±30.43μm and 569.50±46.46 μm, respectively (Figure 6).
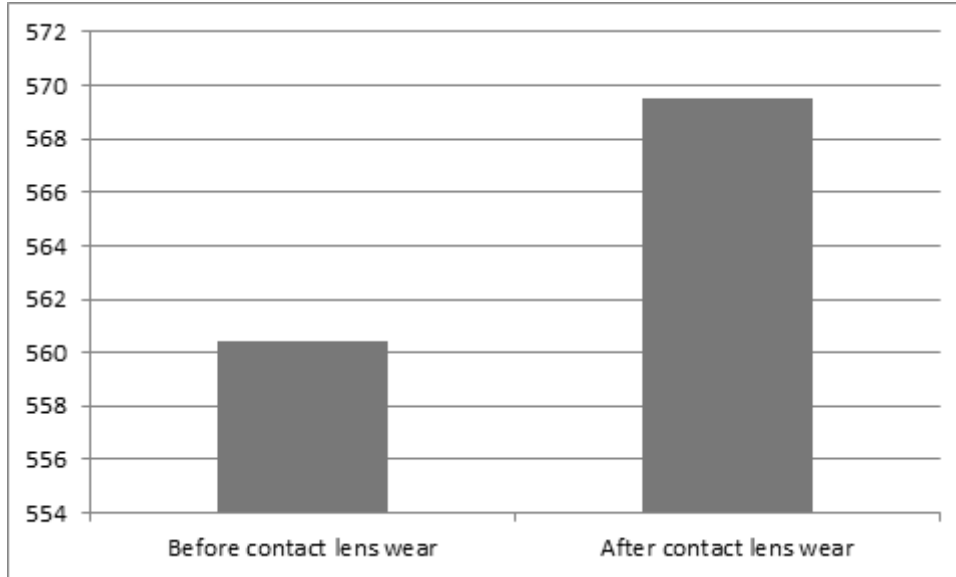

Figure 6 The mean of LCT in the left eye of a Korean subjects. P=0.035

The mean Inferior cornea- thickness before and after wearing color soft contact lenses in the right eye was 570.72±28.98μm and 575.76± 44.69 μm, respectively(Figure 7).
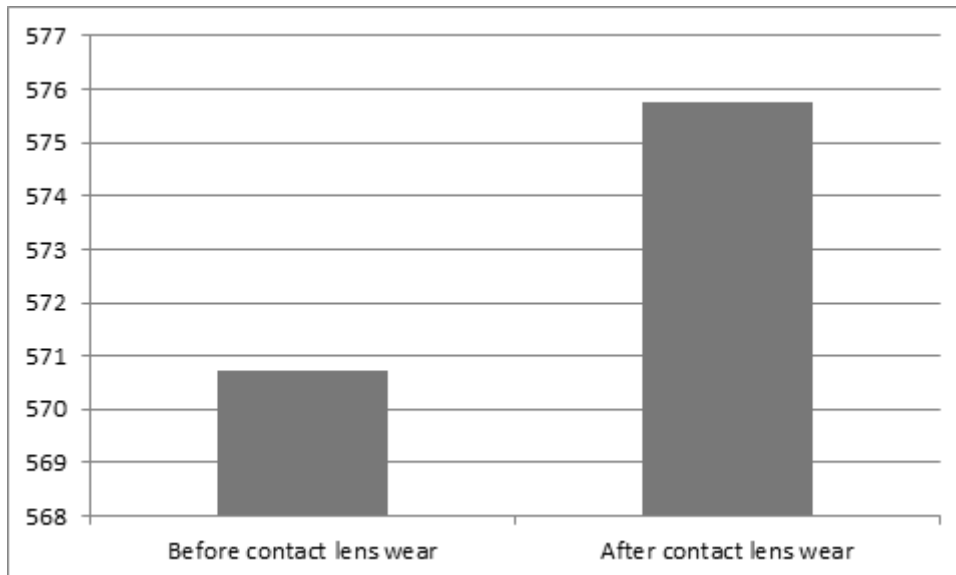

Figure 7. The mean of ICT in theleft eye of a Korean subjects. P=0.012

4. Discussion

In this study, we analyzed the effect of color soft contact lenses on the corneal thickness in young Korean population. For this study, we used the Pentacam system because it easily measures the corneal thickness across the entire surface corneal shape[6]. We think that topography data of corneal thickness are more reliable than ultrasound pachymetry tests. Because the defect of the ultrasound pachymetry is that the target of fixation light and the test area are only dependent on the user[11], therefore, some results of ultrasound pachymetry are unstable. On the other hand, we made that could change the physiologic corneal status because under stable physiologic states the corneal thickness is constant[12]. We especially made care to avoid situations where corneal hydration might be altered because such conditions have been associated with more changes in corneal thickness[10]. Therefore, temperature range during test was maintained as the same conditions (18℃ to 21℃), also the same applied for relative humidity (ranging from 40% to 50%). Furthermore, we performed the corneal topography test at a constant time to avoid the diurnal variation in corneal shape[13]. In the last few years, knowledge of corneal thickness has become increasingly important in clinical diagnosis and treatment[14]. Therefore, pachymetry using the topography System become increasingly established. It shows good reproducibility and accuracy[15]. In this study, we present specific reference values for the Pentacam system and investigate the influence of contact lens wear on the corneal morphology.

In our study, the mean central corneal thickness in right eye was 567.89±28.1μm and 573.07±27.87μm before and after wearing soft color contact lenses, respectively. Also, the mean central corneal thickness in left eye was 567.83±29.23μm and 570.65±39.56μm before and after wearing soft color contact lenses, respectively. Abah Er et al.[16] study showed that the mean central corneal thickness was 526.90mm ±35.3 for Nigerians from adult population. However our study was similar to previously published results in the literature. In studies by Al-Farhan and Al-Otaibi,[17] Williams et al,[18] and Christensen et al [19] mean CCT was recorded as 530.1±30.5 μm, 532.94±37.96 μm, and 552.36±37.6 μm, respectively.

In normal subjects, Florian et al.[20] found that the sex or the side had significant influence on the central corneal thickness. In our study, we found that the corneal thickness have not a significant difference between right eye and left eye in mean corneal thickness.

However, In the soft contact lens wear, the average thickness of the cornea differs depending on the region compared with the case where the lens is not worn.

Especially, we identified that the central cornea thickness of right eye was significantly thicker than that of the cornea that was not worn by the contact lens wearer, which was statistically significant. However, the left eye is not statistically significant. Therefore, we think that the central corneal thickness of right eye was the affected by the contact lens wear.

Soft contact lens usually cause stromal corneal edema which increases spacing between collagen fibrils and affects the biomechanical properties [21]. In our study, we think that the right eye was affected the stromal cornea edema. However the left eye was not affect the stromal cornea edema.

The corneal thickness knowledge of corneal topography is becoming more important. Also the increasing use of corneal diagnosis of refractive surgery is responsible for this. Information about corneal thickness thus permits

the postoperative refractive power to be predicted within certain limits.

In our study, we identified that the right eye was a statistically significant among the CCT, LCT, MCT and TCT values(p<0.001) in the compared the corneal thickness before and after wearing soft color contact lenses. Also the left eye was a statistically significant among the LCT and MCT values(p<0.001) in the compared the corneal thickness before and after wearing soft color contact lenses. However, we identified that there was no statistical difference (p>0.5) in the mean PCT between before and after wearing soft color contact lenses .Therefore , we think that corneal thickness was very useful information in regards to corneal diagnosis and treatment in clinic.

Conclusions: These results suggested that the color soft contact lens wear can the effect the regional thickness of cornea. Therefore, the analysis of corneal topography with Pentacam can provide correct and useful diagnostic information of the morphology of the contact lens fitting and diagnosis of corneal refraction surgery.

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