



## Contact lens compliance among a group of young, university-based lens users in South India

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### RESEARCH

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### Abstract

**Purpose:** To investigate the rate of compliance with the soft contact lens care and maintenance procedures with a focus on contact lens wearing habits, cleaning and disinfecting procedures, and maintenance of lens care accessories in a group of young, university-based contact lens wearers

**Methods:** Two hundred and sixteen young soft contact lens wearers with an age range of 18-22 years were selected conveniently from the student population of Manipal University, Manipal, India. After receiving informed consent from the participants, their level of compliance with contact lenses was assessed using a questionnaire.

**Results:** The mean ( $\pm$ SD) age of the participants was 21.86 $\pm$ 2.35 years. Out of 216 subjects, only 34% of the lens users were identified to be compliant with the least level of compliance observed in the maintenance of lens care accessories. Conventional users showed significantly ( $p=0.001$ ) better level of compliance compared to disposable wearers and so did the users who acquired their lenses from clinicians ( $p=0.001$ ) compared to over-the-counter lens receipt. The gender ( $p=0.496$ ) and years of experience in contact lens use ( $p=0.142$ ) did not show any statistically significant difference in the level of compliance.

**Conclusion:** This study demonstrated that non-compliance with lens care procedures among a group of young, university-based soft contact lens wearers is common. The results indicated that all subjects had some degree of non-compliance and the least level of compliance observed in the care of lens accessories.

#### Key Words

Contact lens, compliance, lens care

#### What this study adds:

1. A better understanding of the compliance rates among contact lens wearers is necessary to improve the safety and efficacy of contact lens wear.
2. Studies conducted in developed countries show that contact lens users are not strictly adhering to the care and maintenance instructions.
3. The observations of this study can provide an insight to the level of compliance of contact lens users, which in turn would be helpful for the practitioners to concentrate on major areas of non-compliance while dispensing the lens.

#### Background

Compliance with contact lens care and maintenance instructions is considered to be the most important aspect of the safe and comfortable use of lenses. The use of contact lenses is known to increase the microbial load in the eye which can adversely affect corneal health,<sup>1</sup> ranging from a mild ocular redness and irritation to a very severe sight threatening situation like *Acanthamoeba* keratitis.<sup>2,3,4</sup> Poor contact lens hygiene and microbial contamination of the lens storage case have been observed to be related to microbial keratitis.<sup>5,6</sup>

Though the contact lens materials and their design have gone through tremendous developments, the level of compliance among lens users is repeatedly shown to be



below par. The status of compliance had been studied extensively and observed to vary between 33-91%.<sup>7-12</sup> The major area of non-compliance identified was in the maintenance of lens care accessories.<sup>13,14</sup> The disposable contact lens users tend to forget the day of replacement or they extend the lens use to save money.<sup>15</sup>

There is no published data available on the soft contact lens compliance status of Indian users to the best of our knowledge. Non-compliance rate is reported to be more in youngsters.<sup>7</sup> Since the majority of lens users fall in the same category, we have tried to assess the level of compliance to soft contact lens care and maintenance procedures among young individuals.

## Method

### Subject recruitment

Two hundred and sixteen asymptomatic soft contact lens wearers ranging from 18-22 years from the student population of Manipal University, India were included in the study. Candidates were recruited conveniently from the contact lens clinic, university campus, hostels etc. and they were interviewed by a group of trained optometry students between October 2010 and January 2011. The category of lens type included was conventional and disposable (except daily disposable) lenses worn on a daily wear basis. Each candidate was interviewed to collect the information about their contact lens wearing history. Type of lens, wearing experience (year), power, wearing time and schedule, duration of lens use in a day and details of care system were among the information collected.

A candidate who used their lenses for a minimum of eight hours a day for a period of six months or more was considered as a contact lens user. If they used their lenses for more than five days a week they were termed a 'regular user' and for less than five days an 'occasional user'.

Prior to the study, ethical approval was obtained from the Institutional Review Board for research proposal and all the procedures performed in relation to this work have complied with the Declaration of Helsinki, as revised in 2002. All the subjects gave written informed consent before participating.

### Assessment of compliance

To assess the level of compliance, the participants were requested to complete a questionnaire (Appendix 1). Items for inclusion were adapted from a published questionnaire<sup>16</sup> and the recommendations from Asia-Pacific contact lens care summit, 2007.<sup>17</sup> The modified questionnaire was subjected to a repeatability test on 20 contact lens using

students twice within two weeks. The reliability analysis of the questionnaire showed 0.8337 (single rater) with 95% CI (0.54-0.95).

A total of 21 questions were used to assess the compliance status and they were categorised under three major aspects of lens care procedures.

Category – I: Wearing and replacement habits (six questions).

Category – II: Lens cleaning and disinfecting procedures (nine questions).

Category – III: Care of contact lens accessories (six questions).

The response to each question was graded using a rating scale from four to one. A score of four was given for the response of always (total compliance), three for often, two for sometimes and one for never (total non-compliance). The questionnaire contained four negative questions too; (Question #3 & 4 in Category-I, Question # 2 in Category-II and Question # 4 in Category-III). For those questions, a response of 'never' was scored with four, 'sometimes' with three, 'often' with two and 'always' with one at the time of analysis. Hence, for the negative questions, a response of 'never' indicated fully compliant and 'always' indicated fully non-compliant. Subjects were instructed not to give a score more than two if they are not carrying out a particular procedure at least half of the occasions. After the participant completed their responses, they were asked to put the questionnaire into an envelope, seal it and deposit it into a drop box. To promote the participant's honesty, they were informed that the envelopes would remain sealed until the end of the study.

It would be difficult to expect a person to be wholly compliant with manufacturer as well as clinician guidelines. However, if a subject is following the lens care instructions most of the time, it is highly unlikely that a significant complication would occur. Hence, subjects with compliance scoring more than or equal to three were classified as 'Compliant' for that lens care procedure. To find out the level of compliance in a specific lens care category (Category-I, Category-II & Category-III), the average score of the responses were discovered and a score > three qualified the subject to be compliant in that category.

After calculating the individual compliance score for all three categories, the overall level of compliance for a participant was assessed. A participant who gained a score of three or more in all the three lens care categories separately was termed as 'Compliant'.



**Statistical analysis**

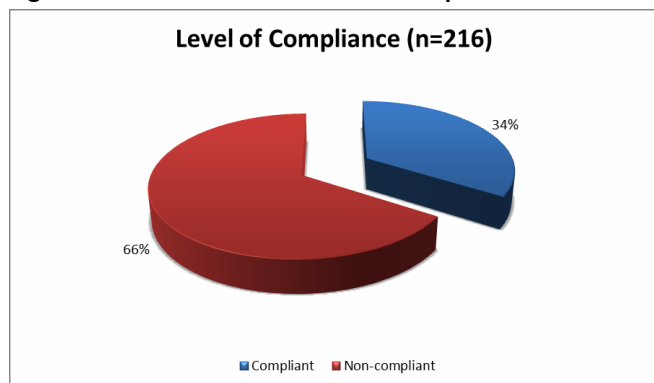
The Statistical Package for Social Science (SPSS) version 15.0 was used for the tabulation and analysis of the data collected. The outcome variable (rate of compliance) was described in terms of proportion. Chi-square test was used to investigate the relationship between compliance and variables like gender, type of soft lenses (conventional/disposable), modality of lens wear (regular/occasional), duration of lens use, mode of acquisition of CL by the user (from a clinician/over the counter sale). A p value of <0.05 was considered to be statistically significant.

**Results**

A total of 216 soft contact lens users, consisting of 175 females and 41 males with a mean age of 21.86±2.35 years participated in this study. Summary of the subject demographics is shown in Table 1. Of the subjects 60% used monthly disposable lenses and 77% wore their lenses on a regular basis. Interviews revealed that the majority of the lens users could recollect the power of their lenses (72.7%) and its manufacturer (94.9%). About 76% of the participants used either soap or antiseptic lotion to clean their hands before handling their lenses. The majority of the participants reported that they received their first pair of contact lenses from an eye care practitioner after a thorough examination and lens fitting procedures. But, almost 1 out of 10 subjects admitted that they were not given proper instructions on lens use and its maintenance at the time of lens dispensing.

Among the subjects studied, only 34% were identified to be compliant, i.e. who managed to get a compliant score of ≥3 in all the three categories of lens care (Figure 1). The least level of compliance was observed in the maintenance of lens accessories (Table 2).

**Figure 1 : Level of soft contact lens compliance.**



**Table 1: Subject demographics & lens wearing schedule (n=216)**

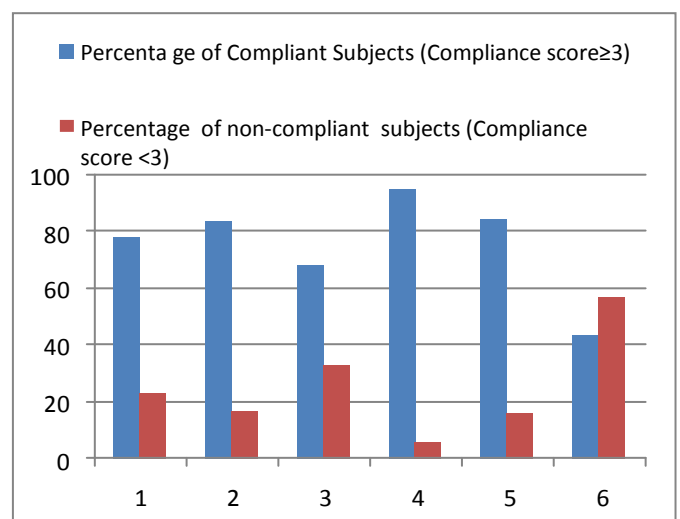
	Mean ± SD
Age	21.86 ± 2.35
CL wearing experience (years)	3.56 ± 2.38
Wearing time (hrs/day)	9.86 ± 3.33

**Table 2: Compliance data in each lens care categories**

	Category I	Category II	Category III
Mean (SD) compliance score	3.14 ± 0.465	3.49 ± 0.383	2.94 ± 0.450
Status of Compliance (%) (Compliance score ≥3)	69%	89%	48%
Median Compliance Score	3.17	3.56	2.83

The assessment of wearing and replacement habits showed 32% of the subjects used to sleep for short periods with their lenses on, 23% wore their lenses more than the recommended wearing time in a day, 17% did not discard their lenses and switched to a new pair as suggested and more than half (56%) of the participants did not attend the recommended after care visits (Figure 2a). Of the participants 69% acquired a compliance score of ≥3 in the category of wearing and replacement habits (Table 2).

**Figure 2a : Status of compliance (Category-I)**

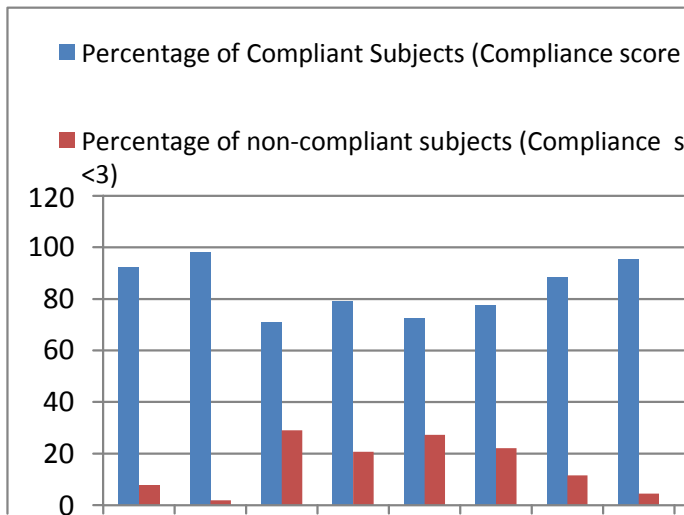


1. Lens wear as per the recommended time each day.
2. Discard the old lens and switch to a new pair as recommended.
3. Nap with lenses on.
4. Sleep overnight with the lenses.
5. Remove the lens immediately if the eye is red or irritated.
6. Attend all the aftercare visits as suggested.



The shortcomings observed in the cleaning and disinfection segment included: 29% did not clean their lenses after they wore them, 21% did not rub both the sides of the lens while cleaning and 27% did not perform the rinsing step after they completed the lens cleaning (Figure 2b). The highest level of compliance was observed in this category (Table 2) and even 84% of the non-compliant subjects scored an average compliance score of  $\geq 3$ .

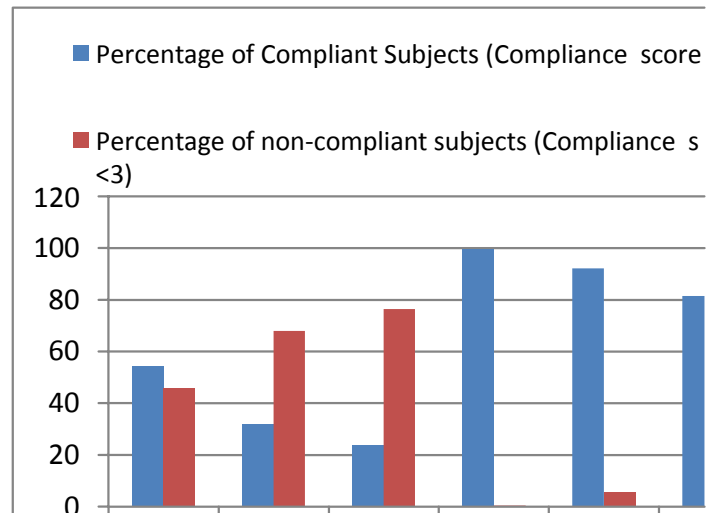
**Figure 2b: Status of compliance (Category-II)**



1. Wash hands before handling lenses.
2. Use tap water/saliva to clean the lenses in the absence of solution.
3. Clean the lenses every day after wearing them.
4. Rub both the sides of the lens while cleaning.
5. Rinse the lenses with the solution after cleaning.
6. Check the lenses for debris and damage before insertion.
7. Use fresh solution to soak the lenses at night.
8. Fill the lens case with sufficient solution while soaking.
9. Soak the lenses for more than 4hrs every night

Non-compliant behaviour was more prominent in the maintenance of lens care accessories (Table 2). Of the participants 76% were not particular about replacing their lens cases every three months. Whereas, only 32% allowed to air dry their lens cases after inserting the lenses and 46% of the subjects did not disinfect their lens case thoroughly once in a week (Figure 2c).

**Figure 2c: Status of compliance (Category-III)**



1. Clean the lens case once a week.
2. Air-dry the lens case after inserting the lens every day.
3. Replace the lens case every three months.
4. Share the lens case with friends.
5. Recap the solution bottle immediately after use.
6. Check the discard date for the solution.

Gender ( $p=0.496$ ), duration of lens use ( $p=0.142$ ) and modality of lens wear ( $p=0.221$ ) does not seem to influence the level of compliance (chi-square test). However, the conventional lens users ( $p=0.001$ ) and subjects who acquired their lenses from an eye care practitioner ( $p=0.001$ ) showed significantly better level of compliance (Table 3).

**Table 3: Association between gender, duration of lens use, mode of lens acquisition, modality of lens wear and type of lens used with level of compliance.**

	Components	Compliant (%)	Chi-Square	$p$
1	Males	29	0.464	0.496
	Females	35		
2	Using CL > 2yrs	37	2.152	0.142
	Using CL < 2 yrs	27		
3	Lens dispensed by Clinician	40	14.414	0.001
	Lens brought over-the-counter	11		
4	Regular User	35	1.495	0.221
	Occasional User	27		
5	Conventional User	48	11.767	0.001
	Disposable User	25		



## Discussion

Claydon and Efron explained compliance in general health in terms of the transaction existing between the patient and the practitioner within the frame of a shared relationship.<sup>18</sup> In the context of contact lens wear, this can be interpreted as a wearer correctly adhering to the instructions provided by the contact lens practitioner with respect to optimum lens wear and care. While using contact lens, it is important that extra burden which is created to the ocular defensive mechanism due the presence of lens should be minimized as much as possible. It is also understood that the shift in the nature of the ocular surface due to the physical presence of the contact lens cannot be completely reverted by any of the techniques. However, it is possible that the increase in bioburden which occurs during contact lens wear can be reduced by the hygiene and lens handling practices of a contact lens wearer.

Our study illustrates the level of compliance is low among a group of young university students wearing soft contact lenses. Only 34% of the studied subjects were maintaining a satisfactory level of compliance. The result seems to be well within the range of non-compliance rate observed in the literature.<sup>8-12</sup> It is clear that the methods adopted to assess the level of compliance was different in all the studies and hence the outcome too. Collins and Carney<sup>8</sup> interviewed the subjects first and then asked to demonstrate their care and maintenance procedures. They classified non-compliance as failing in any of the evaluated steps. On the other hand, Turner and Gower<sup>10</sup> applied a weighting factor to assess the patient behaviour with the potential to cause serious clinical problems to have a greater impact on the overall analysis than those with less serious consequences. Oliviera et al<sup>12</sup> used a questionnaire alone to study the compliance in college students and health workers; but Yung and Boost<sup>16</sup> employed a combination of questionnaire and objective evaluation of the rate of contamination in lens care accessories. Keeping it different from the previous questionnaire-based studies, where they have checked whether a particular procedure had been carried out or not, we have tried to assess the frequency with which each procedure was performed. Moreover, if a subject failed to score a sufficient compliance score in any of the three lens care categories (mentioned earlier) was termed as non-compliant. This stringent way of classifying the candidates would probably have resulted in higher level of non-compliance in our study compared to the previous studies.<sup>7,8,10-12</sup>

A proper hand wash and hygiene has a lot to do in controlling the risk of infection while handling contact lenses as well as in general health. The participants in our

study maintained hand hygiene very well; as many as 92% washed their hands before handling their lenses. Out of that, 76% of them used either soap or antiseptic lotion and the rest used only water. Previous researchers observed higher rate of non-compliance among their subjects; Collins et al<sup>19</sup> – 22%, Morgan<sup>20</sup> – 35%, Collins & Carney<sup>8</sup> – 16%, Turner et al<sup>10</sup> – 40% and Yung & Boost<sup>16</sup> – 35%. The better performance by our participants can be attributed to a superior awareness of hand hygiene among them as the majority of them were healthcare students.

Of the subjects 23% who participated in this study reported that they wore their lenses longer than the recommended daily wearing time. Similar responses<sup>21,22</sup> were reported previously. However, Claydon and Efron<sup>23</sup> observed a higher rate of non-compliance (65%) in this wearing habit. Using lenses beyond their recommended replacement schedule is proved to be associated with increasing infections.<sup>24</sup> Of the participants in this study 17% did not dispose of their lenses as recommended. Yung and Boost<sup>16</sup> also observed a closer pattern (22%). But, Morgan<sup>20</sup> reported slightly higher rate of non-compliance (38%) in the lens replacement habits. A total of 5.6% of the contact lens wearers studied admitted that they slept overnight with their contact lenses which was not actually recommended with the type of lenses prescribed to them. A similar result was observed in a population studied at UK (6.2%) and Germany (7.0%) by Bowden et al<sup>25</sup>. Though the overnight sleeping rate observed was less, 32.4% of respondents said that they do nap with their lenses on. Morgan<sup>20</sup> (33%) too noted the same level of non-compliance. The higher prevalence of nap in contact lens observed in our study may be due to the complacency from the practitioner side to stress the importance of this step especially when dispensing disposable lenses. It is important to note that the unscheduled overnight use with disposable lenses is associated with a four-fold increase in the risk of microbial keratitis.<sup>26</sup>

The category of cleaning and disinfection showed the highest level of compliance as expected (Table 2). Still, 29% responded that they did not clean their lenses once after they had worn them. Cleaning a lens after its day-long use makes more sense and is important in order to remove the debris and possibly to reduce the microbial adherence. The cleaning techniques too require a mention as 21% did not rub their lenses while cleaning and 27% did not rinse their lenses after the cleaning step. This outcome matches the observations made by Sager et al<sup>27</sup> (30%). Morgan<sup>20</sup> (58%) and Claydon and Efron<sup>23</sup> (47%) also reported the non-compliance rate in proper cleaning technique. Due to the





availability of easy-to-use multipurpose solutions (MPS) in the market, the disinfection procedure is less cumbersome and that was reflected in our results too. The better performance observed in the disinfection category could be due to the ease of the system and to the greater stress given to this area at the time of dispensing.

The overall score of compliance noted in the maintenance of lens accessories was the lowest among all the categories (Table 2). Of the participants 52% scored an average compliance score of less than three. Collins and Carney<sup>8</sup> observed the second highest level of non-compliance rate in maintaining the lens cases out of the 14 aspects of lens care they studied. The least level of compliance in the care of lens accessories was no different from the results of other studies.<sup>10,16,20</sup> A significant non-compliance in the maintenance of lens accessories could also be partially attributed to the level of practitioner compliance. While giving lens care instructions, more importance and stress was given to lens cleaning and maintenance steps; leaving the procedures of accessory care.

### Conclusion

This study exemplifies that all the contact lens users who participated have shown some degree of non-compliance in their contact lens care. The poorest level of compliance observed was in the care of lens accessories like contact lens case and solution. Although it is difficult to improve the patient behaviour to the ideal level, as primary eye care practitioners, we have to emphasize all the lens care instructions and reinforce the same at follow-up visits to minimize lens contamination and a possible ocular complication.

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### PEER REVIEW

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### CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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## APPENDIX 1: Questionnaire

For the items given below, please CIRCLE the answer that best describes your soft contact lens care and maintenance routine.

4: Always      3: Often      2: Sometimes      1: Never

### Wear & replacement Habits

1. I **WEAR** my lenses as per the recommended wearing time each day      4 3 2 1
2. I **DISCARD** my used contact lenses and switch to a new pair as recommended      4 3 2 1
3. I do **NAP** (sleeping for short periods) in my contact lenses\*      4 3 2 1
4. I sleep **OVERNIGHT** in my contact lenses\*      4 3 2 1
5. If my eyes look **RED OR IRRITATED**, I remove my lenses as soon as possible      4 3 2 1
6. I **ATTEND** all the recommended after-care visits suggested by my practitioner      4 3 2 1

### Cleaning & Disinfection Procedures

1. I **WASH** my hands before handling my contact lenses      4 3 2 1
2. I use **TAP WATER** or saliva to clean my lenses if no solution is available\*      4 3 2 1
3. I **CLEAN** my lenses every day after I have worn them      4 3 2 1
4. I **RUB** my lenses with solution on both sides each time I clean them      4 3 2 1
5. I **RINSE** my contact lenses with solution after the cleaning step      4 3 2 1
6. I **CHECK** my lenses for debris & damage before insertion      4 3 2 1
7. I use **FRESH** solution to store / soak my lenses after each use      4 3 2 1
8. When I soak my contact lenses, I **FILL** the lens case with enough fresh solution to cover the lenses completely      4 3 2 1
9. I **SOAK** my contact lenses in the solution for more than 4 Hrs every night      4 3 2 1

### Care of Accessories

1. I **CLEAN** my contact lens **CASE** thoroughly with antiseptic solution / soap and air-dry it once a week.      4 3 2 1
2. I allow the lens case to **AIR-DRY** after inserting my lenses each day      4 3 2 1
3. I **REPLACE** the contact lens case every 3 months      4 3 2 1
4. I **SHARE** my contact lens case with my friends\*      4 3 2 1
5. I **RECAP** my solution bottle immediately after use      4 3 2 1
6. I always **CHECK** the 'discard-after' dates of my contact lens solutions      4 3 2 1

\*Negative questions (4 nos)