



Patients' satisfaction of using plastic CR-39 lenses

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ARTICLE INFO

ABSTRACT

Article history

Received: 1 December 2012

Accepted: 16 February 2013

Available online:

20 February 2014

KEYWORDS:

CR.39 ophthalmic lenses, vision comfort, durability.

This article investigated the personal satisfaction of wearing Columbia resin CR-39 ophthalmic lenses in Khartoum state; it investigated comfort, durability and safety of such lenses. The investigation was carried out by questionnaire on 304 subjects. Participants' ages ranged between 5 and 65 years with a mean of 32.22 ± 12.81 years, 178 males versus 126 females. The collected data were analyzed using the statistical package SPSS. The results revealed that significant element of comfort 96% in vision was noted in using CR.39 ophthalmic lenses, in addition to 99.7% of the subjects stated that CR.39 lenses have light weight compared with ophthalmic glass lenses; however 89.5% users clearly stated that durability was poor for those type of lenses; while 96% of the participants pointed that the lenses were safer compared to the ophthalmic glass lenses. It was found that scratches were the main cause of lens colour changes $p=0.001$ and visual blurring $p=0.007$, however; spectacles' cases were found to be a significant cause of scratches. Self selection for clear CR-39 among other types of lenses, has a significant role in discomfort $p=0.046$; 81.9% of participants had chosen plastic lenses by themselves, while 83.1% preferred plastic for their new spectacles. The causes for changing spectacles were found to be scratches (93%) and discomfort (80%). Blurring of vision was found to be in 57.6% and colour changes were 41.1% of the studied group. Based on evaluation by participants the study concluded that CR.39 lenses are comfort, safe compared to glass lenses. However, due to scratches they have short durability

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INTRODUCTION:

Vision is one of the most important function performance plays major role in senses in our modern world. The visual the interaction between individuals and

their activities (Ajay, 2009). Vision science professionals are responsible of helping individuals to achieve a satisfactory vision. Refractive errors can markedly reduce the quality of vision. One of the mean of restoring a satisfactory vision is the ophthalmic lenses. Two types of ophthalmic lenses are available in the market, glass and plastic ophthalmic lenses. Each of the two groups has advantages and disadvantages. Plastic lenses are the most popular in use nowadays. In particular the authors are interested to investigate the possible personal satisfaction of CR.39 ophthalmic lenses wearers. For the prescription of the patient it is very important to select the suitable lens design with the most appropriate lens material, image and fashion are now very much part of modern society, comforts and luxuries are at their peak of demand, desire to look good and enjoy maximum visual comfort are the main requirements. Today a consumer who needs vision correction can select from many exciting new options in lenses that can increase comfort and appearance while providing good vision. These options include lenses that are remarkably light and thin (Ajay, 2010). Most of ophthalmic lenses are now made in some form of plastic. The vast majority of plastic lenses used for ophthalmic application are made from thermosetting plastic. The most widely used thermosetting plastic material is allyl diglycol carbonate (CR-39), whose optical properties are very similar to those of crown glass e.g. $n = 1.498$ and abbe number = 58 (Samson, 1996 and Irving, 2003). Ophthalmic plastic lenses are light in weight and highly safe compared to glass, they are commercially vast preferable and environmentally more friendly, they have high abbe number and easy to dye and coat. They are available in a wide range of powers and forms (i.e. that can be molded into aspheric shapes), has better transmission with less internal

reflections (plastic transmits five to eight percent more light), fogs less in high humidity, can be made to absorb up to 100 % of ultraviolet rays, and offer more resistance to penetration than any treated or untreated glass lens tested for the impact resistance. A considerable advantage in high prescription and large size lenses, an important advantage of plastics is the ability to manufacture low-cost aspheric and complicated curves as in progressive addition lenses, at reasonable costs, all those factors contributed substantially in making the plastic lenses more popular and widely used in the world (Irvin, 1970; Troy and Theodore, 1996; Colin and Keziah, 2001; Crosely *et al.*, 1969). Disadvantages of plastic lenses are a relatively low refractive index (compared to glass), producing lenses with thicker edges than if made in glass; they are also less resistance to scratching and their tendency to warp, in addition to greater care required in handling (Samson, 1996; Irving, 2003; Arthur and Simon, 1983; Venkataswamy, 2007). The principle plastic is a material developed in 1945 called CR-39 which is a thermosetting resin made by polymerization of allyldiglycol carbonate. CR-39 lenses have good impact and scratch resistance, it has an amorphous, crossed structure, and their optical transmission is 92% (Ajay, 2010; Samson, 1969; Colin and Keziah, 2001). Desire of eye glasses wearers falling in one or more of three aspects; cosmetic e.g. thinner more attractive lens, comfort e.g. lighter lens, visual that improved optics. Lenses that have been scratched or pitted should be replaced; the US air force found that there can be up to 20% reduction in impact strength when the front surface of a glass or CR-39 lens is scratched. The break strength of CR-39 lenses decrease by 80% when in rear surface (Crosely *et al.*, 1969; Jalie, 2000). To extend the useful

life of plastic lenses, a certain amount of reasonable caution and care in handling e.g. not wiping lenses when dry, blow of dust, lint and rough particles, as plastic lenses develop a much higher and never us silicon treated cloth or lens tissue on your plastic lenses (Crosely *et al.*, 1969; William, 2006; Brooks, 2003). Despite the importance of CR-39 lenses and their wide use, no research work regarding evaluation was carried out in Sudan. The present study was designed essentially to assess clear ophthalmic plastic CR-39 lenses wearers' satisfaction.

MATERIALS and METHODS:

Three hundred and four [304] subjects were selected from Khartoum state optical centers when patients come to check or change their old clear ophthalmic plastic CR-39 lenses. A questionnaire was prepared and distributed to all optical centers in Khartoum state. The questionnaire included, subjects' age, gender, interest in plastic lenses, properties, selection of plastic lenses, the distance the glasses were used for, period or length using

electrostatic surface charge than optical glass, thus attracting dust particles more easily, for best results, washing lenses with water, blot lenses dry and wipe them lightly with a clean cloth or tissue, spectacles, cause for lenses changing, time duration that lenses were comfortable and vision was clear, lenses substitution time, lens material chosen for the new pair of lenses, keeping of spectacles when not wear, the way of cleaning lenses, and the cost prices of the lenses. A verbal consent was obtained to participate in this study, each subject was asked to answer all questions that were prepared for this study which were carefully explained by the optometrists at the optical centers. After successful completion of questionnaire by participants, spectacle lenses powers were measured using lens meters at optical centers by optometrists (Stephanie *et al.*, 2010). The distributed questionnaires were collected; responses were analyzed using SPSS 16 computer statistical package.

RESULTS:

Three hundred and four subjects participated in this study (126 female, 178 male).

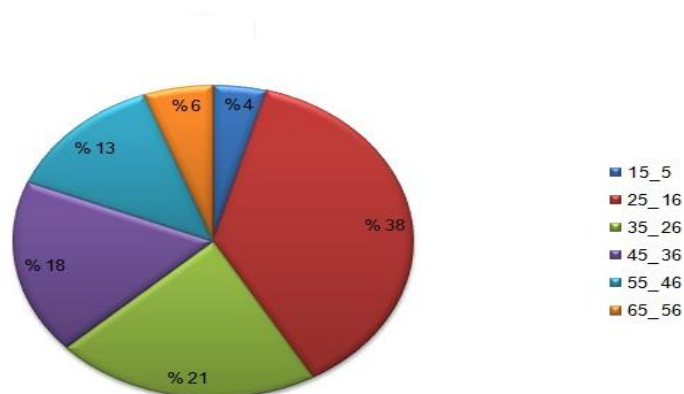


Figure 1: Distribution of participants according to age groups

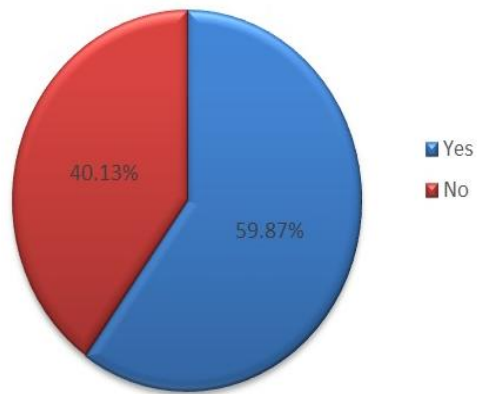


Figure 2: Participants history of using glasses

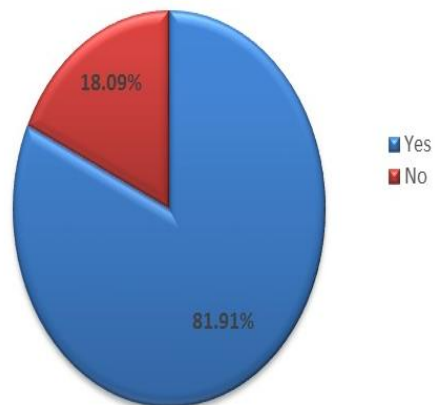


Figure 3: Self selection of plastic glasses by participants



Figure 4: Advantages of plastic over glass lenses as evaluated by wearers

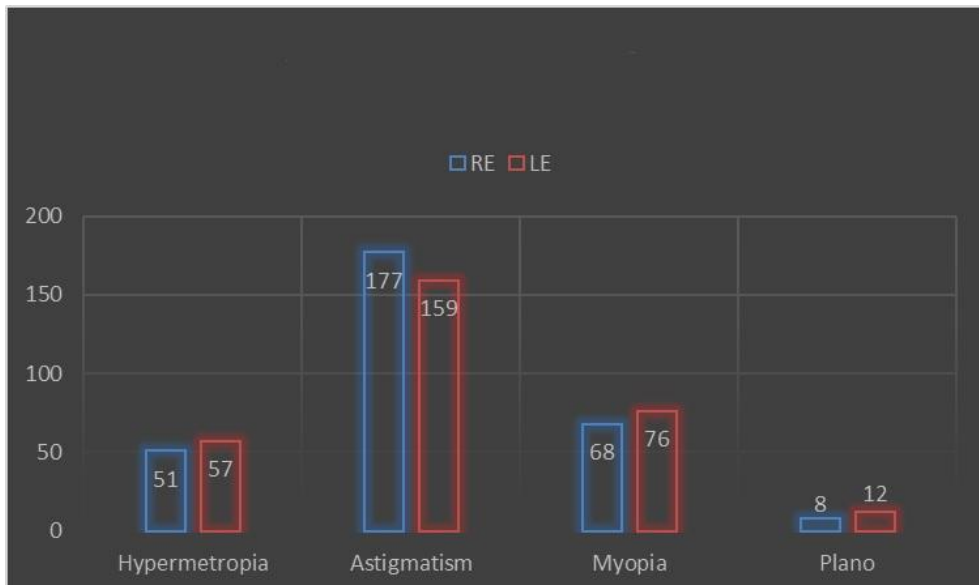


Figure 5: Participants' refractive errors distribution

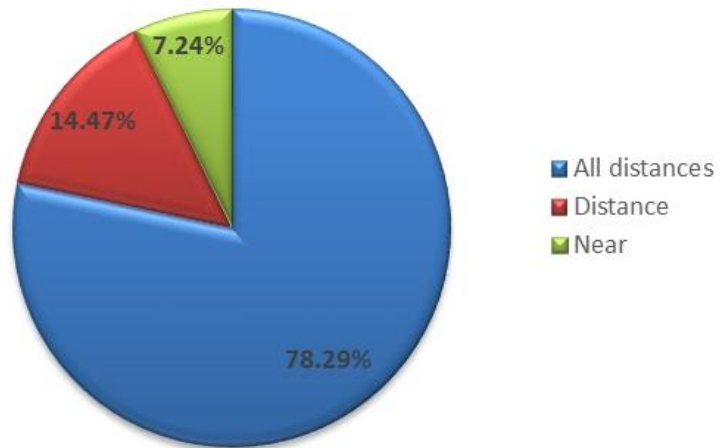


Figure 6: The distance at which participant using glasses

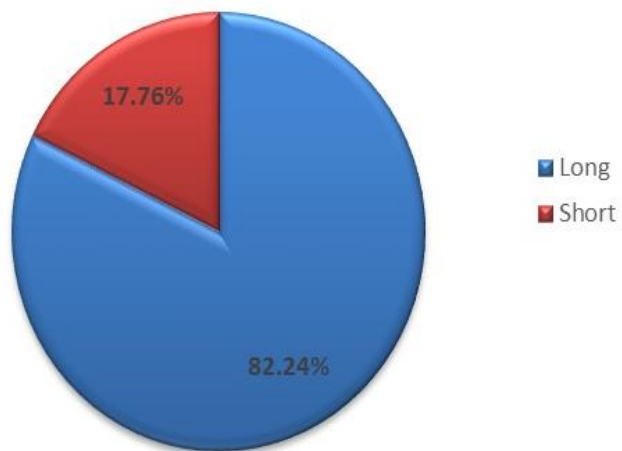


Figure 7: Period length participants wearing glasses

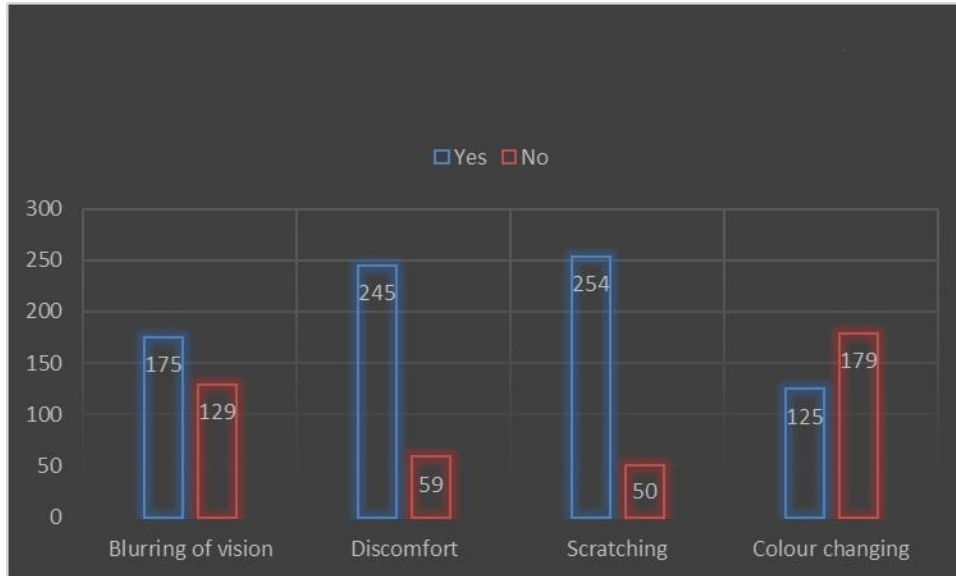


Figure 8: Causes for changing lenses

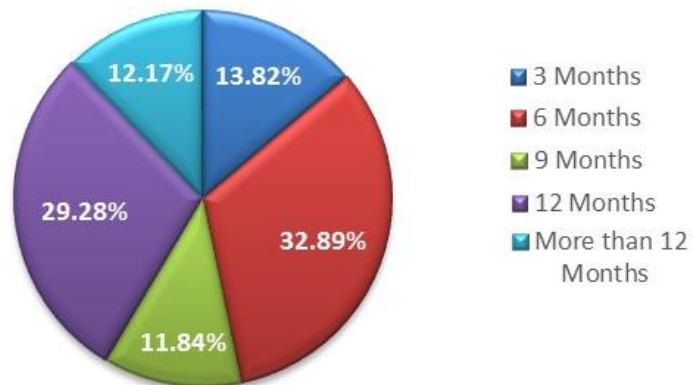


Figure 9: Blurring and discomfort Percealases encountered starting time

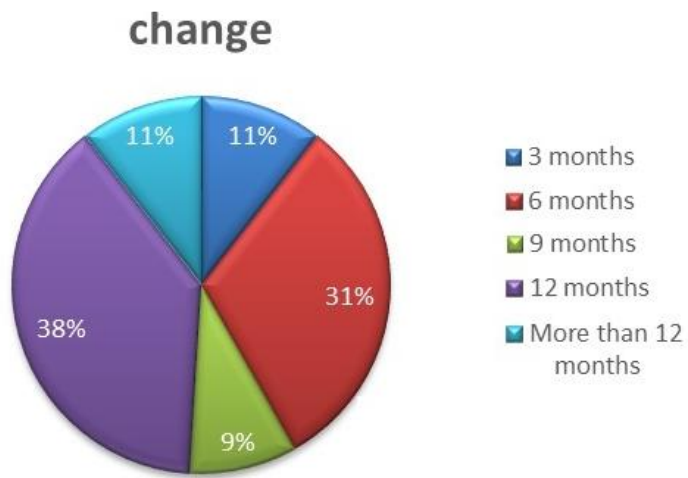


Figure 10: Plastic lenses change time

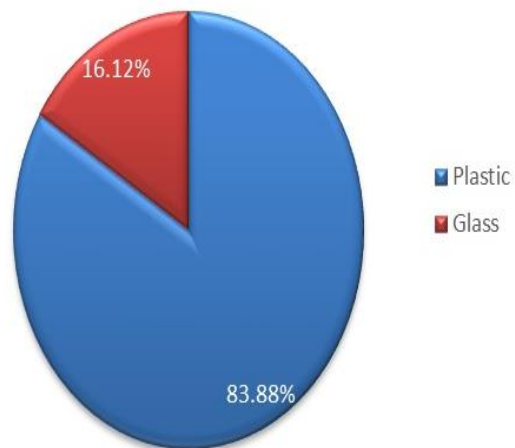


Figure 11: Material of lenses selected by participants for new spectacle

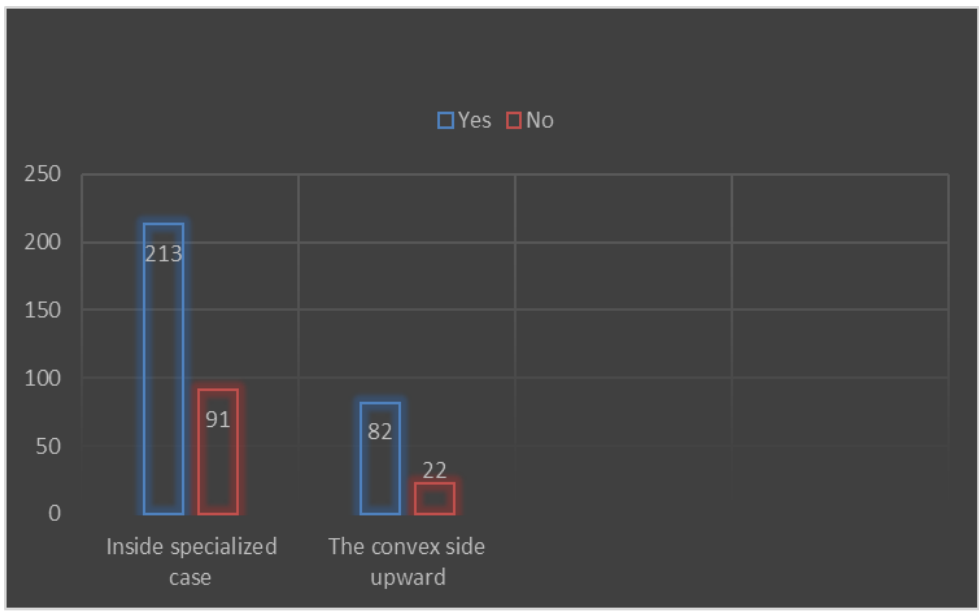


Figure 12: Keeping of glasses in unused state

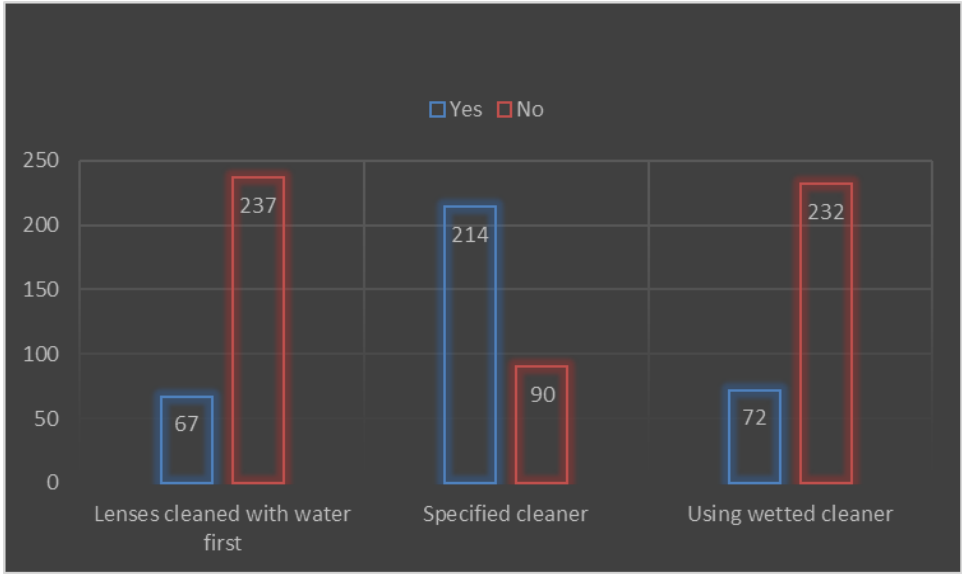


Figure 13: Methods of cleaning lenses

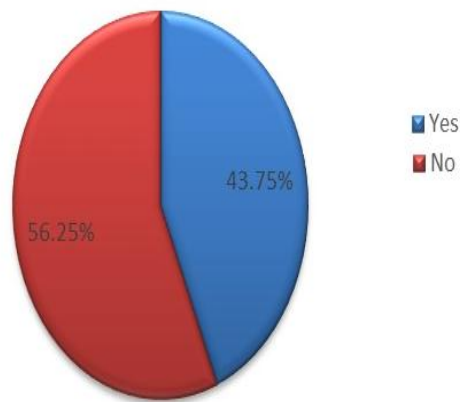


Figure 14: The price cost of plastic lenses

RESULTS and DISCUSSION:

Three hundred and four subjects were included in this study, 178 (58.6%) of which were males, while 126 (41.4 %) were females (figure 1). Age of the subjects ranged from 5 to 65 with mean 32.22 ± 12.81 years as clearly illustrated in figure 2. In figure 3, slightly less than two-thirds (59.9%) of the subjects had experience in using glass lenses. Two hundred forty nine subjects (81.9%) indicated that plastic lenses CR.39 were chosen by themselves, (figure 4). In reference to plastic lenses properties as evaluated by the participants (figure 5), it appeared that CR.39 lenses compared to glass lenses, had light weight (99.7%), Safe (95.4%), beautiful (91.1%) and comfortable (96%). Regarding refractive state of the subjects included in this study, 51 right eyes and 57 left eyes were hypermetropics, 177 right eyes and 159 left eyes were astigmatic, 68 right eyes and 76 left eyes were myopic, 8 right eyes and 12 left eyes had no corrected lens i.e. with plano

lenses, as indicated in figure 5. In reference to glasses distance used 78.3% of the subjects used their glasses for all distances (constant), 14.5% of the subjects used their glasses for distant vision, and 7.2% of subjects glasses were used for near vision. Results in figure 8 showed that 250 subjects worn their glasses for long periods, while 54 subjects worn their glasses for short period. In response to the question why changing their plastic lenses, 175 (57.9%) of the subjects indicated that was due to blur of vision, 245 (80.6%) because of discomfort, 254 (83.9%) because of scratches, while 125 (41.1%) due to colour change in lenses, as clearly illustrated in figure 9. These findings clearly show that the causes to change plastic lenses (CR-39) might be due to one or more of these factors. However, the most important causes in sequence were scratching, discomfort, blur of vision, and change in colour. These findings are consistent with those reported by

Samson (1996) who reported that the useful life of an ophthalmic lens is determined by deterioration in cosmetics rather than a loss of optical performance (Samson, 1996). Figure 10 shows that the time duration participants change plastic lenses varied with individual and was associated with blurring of vision and discomfort in 13.8%, 32.9%, 11.8%, 29.3% and 12.2% of the total participants changed plastic lenses after 3, 6, 9, 12 and more than 12 months, respectively from starting using them. These findings revealed that slightly more than half of the subjects (52%) faced problems with plastic lenses after more than 9 months of use. It is evidenced from the results shown in figure 11, that 32, 95, 28 117 and 32 subjects changed their plastic lenses after 3, 6, 9, 12 and over 12 months, respectively. These results showed that a considerable number of subjects (58.2%) usually start to change their plastic lenses after 6 months or over, which is far distant from that determined by Samson(1966) that the average time between prescriptions is 2 years . As clearly appeared in figure 12, most of the subjects (255) participating in this study indicated that they like plastic CR-39 lenses for substituting their old plastic ones. These findings reflected the continuous and wide spread of plastic lenses in Khartoum state and the satisfaction of CR 39 plastic lenses users from plastic lenses, which is consistent with several reports (Ajay, 2009; Ajay; 2010 and Crosely *et al.*, 1969). In reference to glasses keeping when not in use as shown in figure 13, 213 subjects (70.1%) placed their glasses inside specific cases, in addition to 282 subjects (92.8%) when placed them on a desk top resting on the rear (back surface). These settings

considerably reduce scratching. These findings are in line with that recommended by Crosely *et al.*, (1969); Miller *et al.*, 1979; Brooks; (2003). Statistical analysis showed that there was a significant relationship between placing glasses inside their cases in case not wear and scratches $p=0.037$, this might be due to the quality of the cases. In respect to lens cleaning, as shown in figure 14, only 47 subjects (22%) cleaned their lenses with water before using dry cloth or any other cleaner , while most of the subjects 257(78%) use dry cleaner to wipe their lenses clear, this procedure is believed to be causal in the high scratch production as mentioned by Crosely *et al.*, (1969) and against that instructed by Stephanie *et al* (2010), whom pointed that lenses should be wiped with wetted cloth or tissue, or washed with water and soap before wiped with cloth or tissue. Slightly more than two-thirds of the subjects (70%) used specified cleaners provided by optical centers, as soon as slightly greater than three-quarters (76%) used dry cleaners to wipe their lenses clear. These procedures has a considerable role in high scratches production, particularly plastic lenses develop a much higher electrostatic surface charge than optical glass, thus attracting dust particles more easily (Samson, 1996; Miller *et al.*, 1979; Brooks, 2003). Scratches were found to be a cause of blurring of vision ($p= 0.007$), while a significant relation was found between lenses colour change and scratches ($p= 0.001$). The cross tabulation between self selection for lenses and discomfort was found significant ($p = 0.046$), as well as discomfort and scratches ($p=.034$), and that between scratches and blurring was significant ($p= .034$).

CONCLUSION:

Ophthalmic plastic CR-39 lenses have a number of advantages over glass lenses, with the exception of ease to scratch as evaluated by participants in this study, e.g. light weight, safe. Results showed that most subjects use a dry cloth, or any other tissue to wipe their spectacle lenses clear, which is probably one of the main causes of scratches as well as keeping spectacles inside their cases. Results showed that most of subjects participated in this study preferred plastic CR-39 lenses over the standard crown glass. Scratches have significant relation with discomfort, blurring of vision, lenses colour change, and spectacles cases.

Acknowledgment: Authors would like to thank all who contributed in completing this study specially CR-39 plastic users those participating in replying questionnaire, optical centers and optometrists, and staff of Faculty of Optometry and Visual Science.

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