

# A Systemic Guide for Management of Prosthetic Soft Contact Lenses (PSCL)

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## **ABSTRACT**

*The goal of this study was to demonstrate how prosthetic soft contact lenses can be a beneficial tool for treating a variety of diseases that can reduce a patient's self-esteem and improve his or her quality of life. Different indications, fitting characteristics, and colour possibilities are investigated in order to provide the practitioner with fundamental knowledge as well as a simple, systematic approach to fitting prosthetic contact lenses.*

*Contact lenses with prosthetics are an important cosmetic technique in the treatment of diseased and damaged eyes. This article analyzes general clinical fitting considerations for prosthetic contact lenses and focuses on the use of a novel hydrogel prosthetic lens.*

*The majority of disfigured eyes that require prosthetic contact lenses are caused by corneal and iris abnormalities that can be corrected with off-the-shelf prosthetic contact lenses. A significant number of eyes require personalised prosthetic contact lenses for improved cosmesis and fit.*

*Prosthetic contact lenses, in addition to offering superior cosmesis to evisceration or enucleation, considerably improve the patient's social relationships and well-being.*

## **Keywords:**

*Prosthetic Contact Lenses, Disfigured Eye, Cosmetic improvement, Photophobia, Patching therapy*

## INTRODUCTION

Shiel (2018) defined and expanded on prosthetics by stating that a prosthetic actually refers to any artificial replacement or substitute for a body part. A tooth, an eye, a facial bone, the palate, a hip, a knee or other joint, a leg, an arm, etc. are just a few examples of these bodily components. The prosthesis' allure is that it can be used for both cosmetic and functional purposes. In addition, arthroplasty and replacement are other names for prostheses. The prosthetic contact lens is one of the prosthetics that has been shown to be beneficial.<sup>1</sup>

Prosthetic contact lenses are helpful for many different eye conditions or injuries, including helping to make a prosthetic eye look more realistic in those conditions like; aniridia, or incomplete pupil formation, albinism, or lack of colour in the eye, eye injury or trauma,<sup>2-3</sup> diplopia, or double vision,<sup>4</sup> and eye conditions related to eye sensitivity.<sup>5</sup> According to research by Greenspan (2015), prosthetic contact lenses can help people with light-sensitive eye disorders see better.

In addition to making patients whose eyes had undergone enucleation and evisceration look better, prosthetic lenses also provide hope for treating problems with light sensitivity. Furthermore, it was found in a study by Yildirim, Basmak, and Sahin (2006) that using a prosthetic to cover a disfigured or blind eye can be an effective treatment or medication.

While doing so, the patient's cosmetic look will be improved while the integrity of the orbital anatomy is maintained. The fact that it helps hasten the patient's recovery for their deformed or blind eye is an added benefit.

Patients with specific eye conditions or those who seek to conceal an ocular disfigurement should be fitted for a prosthetic soft contact lens. These individuals require lenses with pigments that are sufficiently dense to cover an ocular surface scar or other damage. In order to meet a functional necessity, they could additionally require a prosthetic lens (for example, iris or pupil occlusion).<sup>6</sup>

Prosthetic soft contact lenses are used to improve the visual function in diseased eyes, enhance the look of a disfigured eye, and for occlusion therapy while cosmetic contact lenses or decorative lenses are used to change the colour of a normal eye.<sup>7-9</sup>

Many patients who could use prosthetic contact lenses for either therapeutic or cosmetic objectives are unaware that they are available. Even though discussing ocular asymmetry or disfigurement can be awkward, doing so can be very beneficial for both patients and doctors. The social interactions and general wellbeing of patients can be greatly enhanced with prosthetic soft contact lenses.

There are several types of prosthetic soft contact lenses available, each with special qualities and restrictions. Depends upon need, therapeutic or cosmetic expectations, and cost, lenses are chosen. Many patients might experience few symptoms like photophobia or diplopia. Others may want to wear contact lenses to hide a defect or to seem better cosmetically.<sup>10</sup>

### ***Psychological prospect of ocular disfigurement***

The biggest issue emerges when you have one or more of these individuals in your community. While most people dislike them, they are seen with a great deal of sympathy by others, who hold out hope that one day, new technology will enable them to see with their affected eye and cosmetically good. Because of their lack of confidence and their fear of

others' judgments and sympathies, even highly educated patients who have ocular deformities are frequently reported to be stressed. For these reasons, they keep going to different clinics in India and abroad, But when they discover no chance of realising their vision again, they frequently become discouraged and prefer to live in isolation.

As a result, we lose excellent individuals who have the potential to accomplish extremely significant and kind things for others. By chance, we are now located the prosthetic contact lens services in eye care centres, many different patient they come and visit the services and opted for ocular prosthesis, and we have gotten a positive feedback that patient feels back once the prosthesis system work is done for them like new world with a new face.

**Principle of Prosthetic Contact Lenses:**

A Prosthetic contact lens is designed to change the look of the eye as well as controls or block the light. [i.e relieve from disfigurements, photophobia and uses in occlusion therapy]

**Indications**

There are various indications for prosthetic contact lenses listed below;

**Table 1:** Prosthetic Contact Lens Indications/Uses

<b>Iris</b>	<b>Cornea</b>	<b>Crystalline Lens</b>	<b>Globe</b>	<b>Others</b>
Aniridia	Microcornea	Leukocoria	Phthisis bulbi	Diplopia
Coloboma	Band Keratopathy	Dense Cataract	Buphthalmos	Photophobia
Heterochromia	Advanced Arcus	Aphakia	Microphthalmos	Amblyopia
Polycoria	Leukoma			Color deficiency
Albinism	Corneal scarring			Rod & Cone dystrophy
Failed Pupilloplasty	Bullous Keratopathy			Cosmetic alignment in strabismus
Iris Atrophy	Failed Graft			Macular aplasia
Rubeosis Iridis	Corneal Opacity			
Fixed or Dilated Pupil				
Iridectomy				

**Contraindications:**

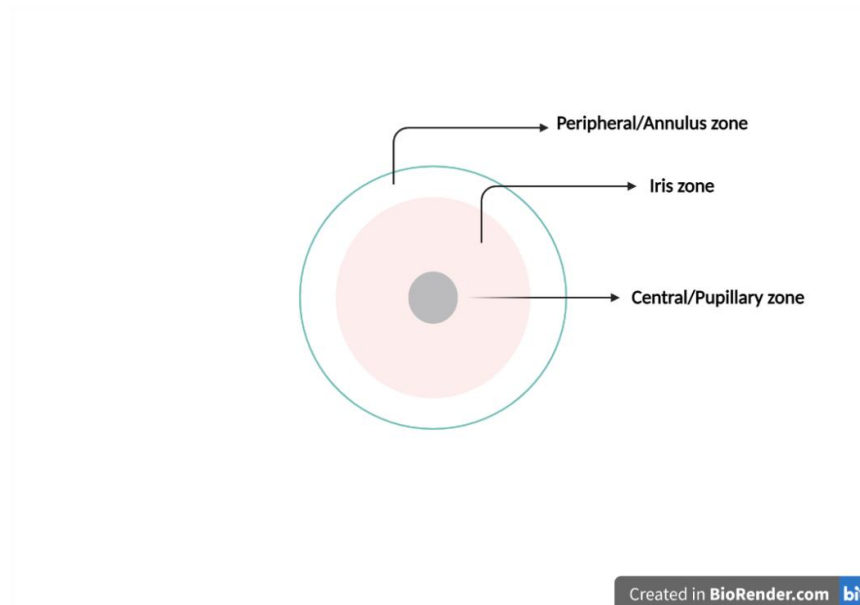
When a sizable section of the anterior eye is diseased, when the patient has previously worn soft contact lenses, or when the patient wants to wear the contact lens on occasion basis, soft prosthetic contact lenses should be utilised.

Soft prosthetic contact lenses are not recommended for eyes with moderate to advanced neovascularization and moderate to severe dry eye. People who have issues with motor coordination may find it challenging to wear soft prosthetic contact lenses.

### ***Zones of Prosthetic CL:***

There are mainly three zones available in the Prosthetic CL, such as:

- 1) Central Pupillary Zone (Black or Clear)
- 2) Tinted Iris Zone (Clear or Tinted)
- 3) Clear Peripheral Zone or Annulus



**Figure 1:** Zones of Prosthetic Contact Lenses

### ***Types of Prosthetic CL:***

A. *Depends upon manufacturing-*

#### **1. Translucent Tinted Lenses:**

Translucent tinted lenses enhance the natural tones by having a uniform hue throughout the tinted region of the lens that overlaps the iris. Translucent lenses are frequently used to enhance natural eye colour or conceal minor imperfections.

Translucent colored patterns might change a patient's perception or brighten their eyes. They have distinct pupil options and a same iris colour. Lighter transparent colors do not perform well as an artificial iris since they preserve the eye's inherent detail. Darker brown translucent tints have the ability to conceal imperfections. You can choose between a transparently colored, clear, or black pupil.

Patients who require a coloured filter on one or both eyes to improve visual function also wear transparent tinted lenses. Patients with limited eyesight, those with colour blindness, or athletes all fall under this category. It may take some trial and error to determine the precise colors needed to have the intended effect for different patients.

There are several types of tints available, including:

- o Light tint
- o Medium tint
- o Dark tint

## 2. **Computer-Generated Lenses:**

There are numerous popular iris colour patterns and sizes for computer-generated lenses. When compared to hand-painted lenses, these lenses are less expensive and offer superior reproducibility. The iris appearance of computer-generated lenses is created by overlaying numerous different colour patterns during dot-matrix printing. The natural eye features of the patient will be partially occluded by an iris colouring pattern without an opaque underprint.

The iris hue and pattern of computer-generated prosthetic contact lenses are predefined, and there is a smaller range of iris and pupil sizes in distinct incremental increments. To provide a more realistic look, many computer-generated designs combine or layer many hues. Full iris occlusion is provided by iris detail over an opaque backdrop, which also hides any underlying irregularity.

In the absence of an opaque backing, only a partial iris occlusion will occur, leaving some of the natural iris detail exposed. Solid black lenses may be the greatest colour match for patients with extremely dark eyes. For some lens designs, the underprint color, such as black or gray, can change how the iris colour is ultimately viewed.

## 3. **Hand-Painted Lenses:**

Prosthetic contact lenses with hand-painted designs provide the most unique appearance. Complete control over variables including diameter, base curve, iris diameter, pupil size, and iris colour is possible with this lens design. Additionally, more complex ocular characteristics like blood vessels, limbal rings, and iris flecks and coronas can be included.

Additionally, it is simple to decenter the artwork in order to increase symmetry with the patient's healthy eye. An illustration of this is the aesthetic repair of strabismus-related eye alignment. When a realistic-looking eye is required, hand-painted lenses should be used.

Hand-painted lenses provide an entirely unique appearance. It is possible to include specific details, such as iris nevi or a painted sclera with blood veins. It is simple to decenter the iris artwork to better line it with patients' natural iris detail or to aesthetically realign the eyes in strabismus situations.

### B. *Depend upon purpose of use-*

#### 1. **Type-A** (Clear iris with black pupil)

Type-A is used for patching therapy or for cosmetic reasons, by controlling the light entrance into the eye.

#### 2. **Type-B** (Tinted iris with no pupil)

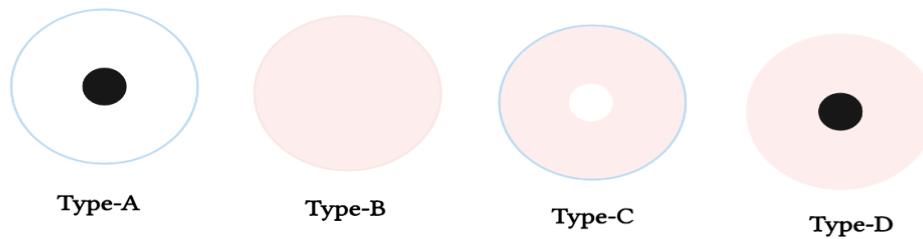
Type-B is used for non-seeing or blind eyes.

#### 3. **Type-C** (Clear pupil with tinted iris)

Type-C is used to enhance visual function by controlling light entrance in an eye.

#### 4. **Type-D** (Tinted iris with black pupil)

Type-D is also used for non-seeing or blind eyes.



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**Figure 2: Different types of Prosthetic Contact Lenses**

**Table 2: Types of Prosthetic CL and It’s Uses**

Types of Prosthetic CL	Uses
Type-A	Patching therapy (Amblyopia), Leukocoria (Cataract), Cosmetic reasons etc.
Type-B	Non-seeing or Blind eyes
Type-C	Microcornea, Corneal Opacity, Adherent Leucoma, Band-shaped Keratopathy, Iris Coloboma, Dilated Pupil, Iridectomy, Polycoria, Heterochromia, Aniridia etc.
Type-D	Corneal Opacity, Phthisis bulbi, Rubeosis Iridis, Hyphema, Iris Coloboma, Aniridia, Leukocoria, Keratinized Cornea, Anterior Staphyloma etc.

**Table 3: Main reasons for Prosthetic Soft Contact Lenses (PSCL)**

Conditions		Manifestations	Benefits
Globe abnormalities	Phthisis bulbi	Disfigured	Cosmesis
	Buphthalmos	Disfigured	Cosmesis
	Trauma	Opacified (bluish white)	Cosmesis
Cornea	Band Keratopathy	Opacities (band-shape)	Cosmesis
	Advanced Arcus	Opacities	Cosmesis
	Leukoma	Opacities	Cosmesis
	Corneal scarring	Opacities	Cosmesis
	Microcornea	Decreased iris size	Cosmesis
	Failed graft	Disfigured	Cosmesis
Lens	Dense cataract	Opacified	Cosmesis
	Aphakia	Photophobia	Light control, Comfort

Vitreous & Retina	Retinal detachment Vitreous detachment Macular aplasia Hypoplusia	Photophobia Photophobia Photophobia Photophobia	Light control, Comfort
Iris	Aniridia  Coloboma Polycoria Heterochromia	Glare, Photophobia  Disfigured Diplopia Different pigments	Light control, Comfort Cosmesis Light control Cosmesis
	Amblyopia	Lazy eye	Total occlusion (patch eye)

**Benefits of PSCL:**

The purpose of soft prosthetic contact lenses is to offer cosmetic, therapeutic, and psychological advantages. Patients who use these contact lenses frequently suffer catastrophic injuries to their eyes or corneas that have altered their appearance or have congenitally deformed eyes. We can provide these patients a pleasant option that comes with a lengthy list of important advantages by fitting them with specially produced soft prosthetic soft contact lenses.

Prosthetic soft contact lenses can offer a number of advantages<sup>11-12</sup>:

- Provide cosmetic improvement
- Natural-looking
- Confidence is increased,
- Peace of mind,
- Excessive light sensitivity is reduced,
- Double vision issues are resolved, and
- Color and contrast enhancement are improved.

**PSCL Materials & Modality:**

Prosthetic soft contact lenses usually need the use of Methafilcon (53% water content), Ocufilecon (55% water content)<sup>13</sup>, Phemfilecon-A (55% water content)<sup>14</sup>, lens materials. These materials are best for adherence of the pigments used for prosthetic contact lenses.

Extended or continuous wear is typically advised when using prosthetic contact lenses.

**Preliminary examination-**

In order to help choose the first trial lens, the preliminary prosthetic contact lens fit examination's primary goal is to:

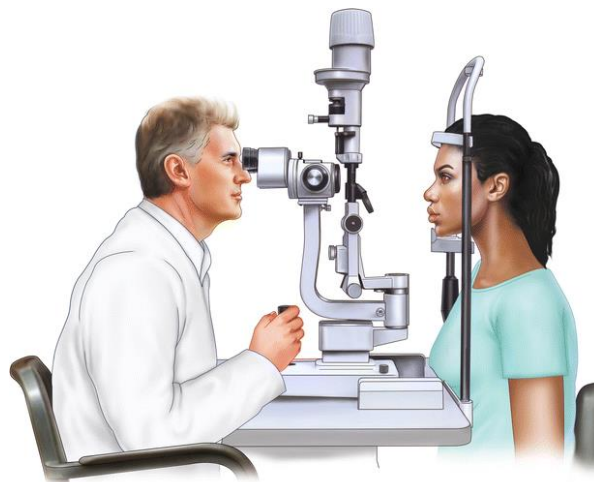
1. Measures ocular parameters to aid selection of the first trial lens.
2. Verify that the ocular structures are normal and note any acceptable abnormalities for later use (e.g. corneal scar resulting from a historical eye injury).
3. Identify problems that might prevent or restrict the use of contact lenses (and treat or refer if necessary), or problems that point to the necessity for a specific kind of contact lens.

4. Permit the collection of baseline data against which to assess potential changes brought on by contact lenses.

Prior the fitting is complete and a lens specification is produced, the subject typically needs to try the prosthetic soft contact lenses and visit for the initial follow-up examination.

The following is part of the preliminary examination, and is further explained in the parts that follow:

1. Prior fit case history to find out actually what the patient wants from prosthetic contact lenses, what they are aware of, and to help establish suitability
2. Evaluations to help determine lens parameters
3. Evaluations to assist in determining fitness for lens wear, tear film quality and anterior eye health. The posterior segment is only examined during the pre-fit examination if any new symptoms or indicators suggest that further testing is necessary or if it has been a long time since the previous evaluation.
4. Select the prosthetic trial lenses: Following the initial evaluation, you must summarise your findings and explain how they affect the type of lens you select. There may be a clear indication for a specific type of lens, such as single-use lenses for a patient who wants to wear lenses only twice or three times per week. Alternatively, there may be a variety of options, in which case you should discuss the benefits and drawbacks of each lens type with the patient so that they can make an educated choice.
5. Evaluation after the trial: Examine the prosthetic trial lenses' performance in terms of fit, compatibility with the tear film of the eye, and visual acuity.
  - a) To satisfy the patient's needs, it might be required to trial many lenses.
  - b) Take off the lenses and use the slit lamp to examine the eyes.
  - c) Go over the results with the subject.
6. Counsel the patient about handling and care for the prosthetic lenses: Make sure the patient is completely aware of the pros and cons of wearing prosthetic lenses as well as the significance of maintaining the prosthetic lenses and lens cases.
7. Final examination of trial lenses: Give the subject a few days to try the prosthetic lenses. Conduct the initial follow-up examination with the prosthetic lenses in place, and if all is OK, order the final prosthetic lenses and gives the patient a copy of their contact lens prescription.



**Fig 3:** Preliminary slit-lamp eye examination

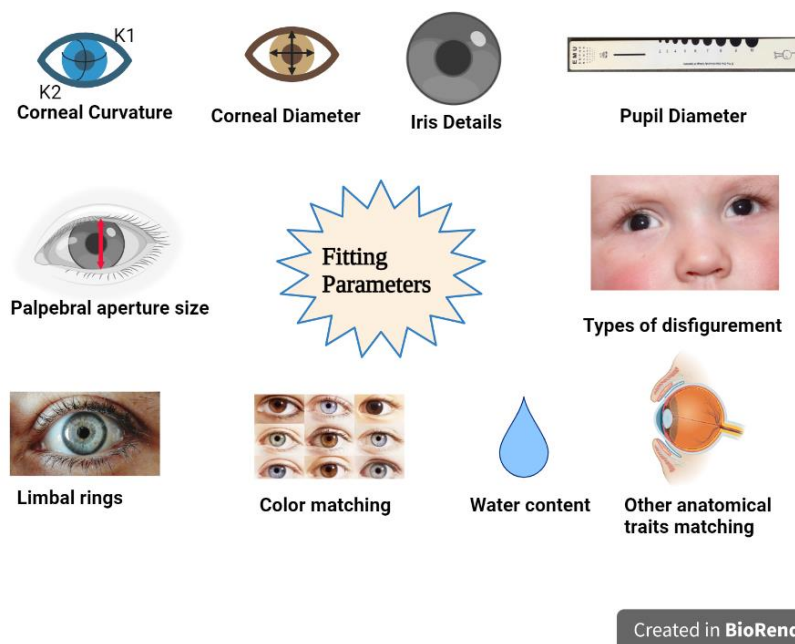


### ***Fitting Parameters:***

The process for fitting a prosthetic contact lens is similar to that of a regular hydrogel soft contact lens fitting, with a few additional parameters.<sup>15-17</sup>

To accomplish the cosmetic or functional purpose, each case should be handled separately, with special concerns being emphasised. Before the fitting process starts, the practitioner should explain to the patient what can be practically accomplished with a prosthetic contact lens. Unfortunately, depending on their conditions, some patients cannot achieve the desired appearance.<sup>18-19</sup>

- Corneal curvature<sup>20-21</sup>
- Corneal diameter in the horizontal and vertical dimensions<sup>18,22</sup>
- Iris detail like- flecks, spokes, etc<sup>13</sup>
- Pupil diameter in bright, dim and normal room illuminations<sup>14</sup>
- Palpebral aperture size<sup>23</sup>
- Limbal ring detail like- thick or thin, and color<sup>13</sup>
- Iris color matching<sup>24</sup>
- Type of disfigurement<sup>6</sup>
- Water content<sup>25</sup>
- Other anatomical traits to match



**Figure 4:** Fitting parameters of Prosthetic Contact Lenses.

### ***Fitting Assessment:***

#### ***Ideal soft contact lens fitting***

Evaluating both static and dynamic variables is required when judging fit. The perfect prosthetic contact lens fit should include the few features like:

### **Corneal coverage**

The prosthetic lens should cover the cornea in all positions of gazing, including primary gaze. This is to avoid desiccation of an exposed cornea, which would result in epithelial staining.

### **Dynamic fit**

To allow metabolic debris from the cornea to be expelled, the lens must facilitate tear exchange. Prosthetic soft contact lens movement is now well documented to play just a minimal influence in corneal oxygenation. When compared to rigid lenses, the tear pump effect of soft lenses is low. This is important in the care of the Prosthetic soft contact lens patient. To reduce hypoxic symptoms in hydrogel lens wearers, the practitioner should not enhance lens movement.

### **Alignment**

The lens should not indent conjunctival vessels and should align with the cornea and conjunctiva. Indentation would imply a buildup of tears in this area as well as a reduction in oxygen flow to the limbus. Similarly, there should be no edge standoff (fluting) on the lens, which would cause distress.

### **Lens centration**

In all positions of gaze, the prosthetic lens should be about centralizing to the cornea. Failure to do so may result in corneal desiccation and mechanical stress on the peripheral cornea.

### **Patient response**

When the aforementioned parameters are met, the patient should experience a high degree of comfort, sharp and stable vision. The physical fitness and performance criteria are summarised in Table 4.

**Table 4:** Fitting requirements for Prosthetic Contact Lenses.

<b>Fitting requirements for Prosthetic Contact Lens</b>	
<b>Lens Performance</b>	<b>Physical Fit of PSCL</b>
Comfort	Centration
Stable vision	Full Corneal coverage in all position of gaze
	Optimal movements

### ***Insertion & Removal***

#### ***Insertion***

- 1) Position the lens on the tip of your dry, clean index finger.
- 2) Pull and hold your upper eyelid with your other hand, so that you cannot blink.
- 3) Using your inserting hand's middle finger, pull your lower lid downward.
- 4) As you raise your head, carefully place the lens on your lowerwhite part of your eye.
- 5) To properly set your lens, look down.
- 6) Releasing your eyelids gradually
- 7) For 10 seconds, close your eyes.
- 8) Next, blink repeatedly. This will assist the lens in centering on your eye.

- 9) If the lens feels uncomfortable, it can be because tiny dust particles were caught behind it as it was being placed. Simply move the lens with a finger off to the side of your eye and then back if this should occur.

#### *Removal*

- 1) Ensure that the lens is centred in your eye before taking any action.
- 2) Lift your lower eyelid with your inserting hand's middle finger while you look up.
- 3) At this point, put your index finger so close to your eye that it blocks part of your field of vision.
- 4) Slide the lens to the lower white portion of your eye by touching its lower edge.
- 5) Gently squeeze the lens with your index and thumb.
- 6) At this point, remove your eye's lens.
- 7) Follow the lens care regimen recommended by your eyecare practitioner.

#### ***Care & Maintenance:***

A general set of guidelines to assist in patient education.<sup>26</sup>

- 1) Always follow to the CL wear and replacement plan advised by your ECP.
- 2) Prior to handling CLs, wash your hands. Use a fragrance-free soap and a lint-free towel to dry your hands.
- 3) Consistently use the lens-care items that your ECP suggests. Saline solution and rewetting drops don't clean or sanitise your lenses, and not all solutions are compatible with all types of lenses.
- 4) For CL disinfection, follow the exact instructions listed in the packaging and package inserts.
- 5) Never put your contacts in your mouth or wet them with saliva, and never rinse your lenses with tap water.
- 6) Never top off the solution in your lens case or reuse old solution.
- 7) Always take out your lenses before getting in the shower, a hot tub, or the swimming.
- 8) If your eyesight worsens while wearing lenses or if your eyes become red, irritated, or painful, remove your CLs as soon as possible and visit your ECP immediately.
- 9) Consult your ECP at least once a year, even if you're not experiencing any issues, to check on the health of your eyes and evaluate if your existing lenses and eye care products are still the best option for you.

In a 2014 Morbidity and Mortality Weekly Report, important additional points were raised, including the following,<sup>27</sup>

- 10) Avoid keeping CLs in water.
- 11) Every three months, swap out CL cases.

#### ***Complications:***

There are similar issues with wearing prosthetic contact lenses as there are with other contact lens varieties, although there are few ailments that stand out, such as<sup>28-39</sup> Contact lens discomfort, Corneal neovascularization, Bacterial, Fungal & Acanthamoeba keratitis, Giant papillary conjunctivitis, Corneal staining, Dry eye, Corneal oedema, Allergy aggravation, Mucin ball, Herpes reactivation etc.

#### ***Dispensing & Follow-up:***

The maker of the chosen lens should be consulted by the practitioner because exact instructions may vary depending on the materials and colours.

Certain solutions may cause some lenses to deteriorate (such as; hydrogen peroxide-based solutions and few preservatives play a major role in the cleaning solutions e.g. poly-vinyl alcohol and sorbitate).<sup>40-42</sup> Few patients also experience allergic reactions to contact lens cleaning solutions.<sup>43</sup>

Due to the possibility of prosthetic contact lens wear-related issues in the future, regular follow-up must be planned as part of prosthetic contact lens fitting. Mild corneal stippling, blepharitis, and conjunctivitis could emerge at any point during the lens wearing schedule, just like with any soft lens fitting. Depending on the irregularity of the patient's cornea and the mechanical irritation the lens causes, they may have punctate keratitis.

It is advised to utilise sodium fluorescein to do a post-wear slit-lamp examination and contrast the pre- and post-lens state. Many eyes are not sufficiently healthy to withstand the mechanical stress of a lens, and using a lens may make some disorders worse.<sup>18</sup>

## CONCLUSION

An easier and less traumatic alternative to managing an eye for cosmetic purposes using enucleation, evisceration, rigid scleral shells, or coloured and painted prosthetic lenses is the use of prosthetic lenses. Because modern materials have good oxygen transmissibility values, hydrogel lenses are simple to fit, reliable for the patient, and can be worn for a long duration of time. The changes brought about by prosthetic lenses can be rather significant. The patient with a disfigured eye covered with a prosthetic lens will be considerably more confident, have enhanced self-esteem, and be able to interact with his/her eyes once again instead of glancing at the floor and avoiding looking directly into someone's eye.

In order to remove build-up and prevent fading lens pigment, compatible care systems should be advised for these lenses because their replacement schedules are frequently annual or quarterly. To protect the fellow seeing-eye, polycarbonate eyewear should be provided for full-time use over the contact lens. It's possible that many people who may benefit from prosthetic lenses are not aware that they are available. By fitting these lenses, specialists in contact lenses may start the discussion and massively improve their patients' wellbeing.

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