
WETTABILITY – ANOTHER PARAMETER FOR GOOD FITTING OF A SILICONE-HYDROGEL DAILY DISPOSABLE CONTACT LENS

Nikola PeevSofia university “St. Kliment Ohridski”, Bulgaria, peev.nikola@phys.uni-sofia.bg

Abstract: The modern world is very fast and dynamic. Consumer requirements rise to every commodity part of their everyday life - food, clothing, cosmetics, and medical devices. Eye care and eye health are also part of them. Companies producing contact lenses work daily to improve the safety and comfort of wearing, as well as on the technical characteristics of the material (type of material, wear time, module, Dk / t etc.). Silicon hydrogel contact lenses (SiHy) were introduced almost two decades ago. At that time it was estimated that there are about 70 million contact lenses all over the world. Since then, their number has doubled and a significant majority now have silicone-hydrogel contact lenses, resulting in a steady and noticeable reduction in the number of regular hydrogel lenses. When the first one-day silicon-hydrogel contact lenses were introduced in 2008, they were announced as breakthroughs in technology. When they were introduced to the market, they were presented in spherical, toric and multifocal designs, which led to a significant increase in the use / prescription of silicon-hydrogel daily disposable contact lenses. A survey conducted in 2014 by the International Consortium illustrates this point. Although, according to this study, the use of SiHy contact lenses varies widely across the world. In the United States, Canada, Australia and the United Kingdom, four to six times more patients were fitted with silicone-hydrogel CLs compared to hydrogels in 2014 and in each country, daily disposable SiHy contact lenses were prescribed with a larger frequency compared to daily disposable hydrogel lenses. It is important to make a good fit to ensure and increase the comfort of wearing contact lenses. In addition to some of the standard fitting techniques such as: keratometry and choice of base curve of the lens; size and eccentricity; an assessment of the mobility of a lens placed in the eye - look positions, mobility, push up test, can be added and the wetting of the contact lens. Even in perfect fit, if the lens does not interact well with the tear film, it would lead to complaints and discomfort in the patient. The degree of wetting is determined by the balance between adhesive and cohesive forces acting on the surface of the lens. CLs, which can support full wetting, allow a tight coating of the tear film, a smooth recovery of the tear layer after eyelid opening and good visual acuity. The interaction between CL, eye surface and tear film is vital to their successful fit. It has long been known that both the organic and inorganic components of the tear film and anterior surface of the eye can deposit deposits on the contact lenses. There are various non-invasive methods for assessing the tear film and, above all, the lipid layer. Some of these are Non invasive breakup time (NIBUT) and specular biomicroscopy. In the present work we will look at daily disposable silicone-hydrogel contact lenses that have been tested *in vivo* for good wetting, stability and good regeneration of the tear film.

Keyword: contact lenses, silicone-hydrogel, wetting.

1.INTRODUCTION

The study of *technavio* predicts that the global soft contact lens market will grow steadily with a compound annual growth rate (CAGR) of about 8% by 2021. One of the major engines in this market is the rapidly growing number of eye diseases such as refractive error, cataracts and glaucoma, diabetic retinopathy, age-related macular degeneration, etc., which, if not treated promptly, results in visual impairment or blindness. Increasing the use of digital devices and devices, including game consoles, computers and other electronic products, is one of the main factors contributing to the increased prevalence of these diseases among young people over the last decade. Other daily factors such as smoking and exposure to ultraviolet light further increase the likelihood of developing these pathologies. Also, the sudden increase in the diabetic population is another reason for the increase in the number of eye diseases. Geographically, America holds the largest market share in 2016 and will continue to dominate the market in the future. Exponentially increasing incidence of eye diseases, technological advances and awareness raising for soft contact lenses will increase the growth of the global soft contact lens market over the projection horizon. It can be expected that this will lead to increased open competition and development of new technologies and materials for CL production.^{xiii} In addition to eye diseases, there are general diseases that need to be treated with certain drugs that can affect some parts of the eyeball. For example, corneal changes occur in people with coronary heart disease, which can change the quality of vision due to cordarone accept.^{xiv} For this reason, it is monitored for the required dose that a patient can take.^{xv}

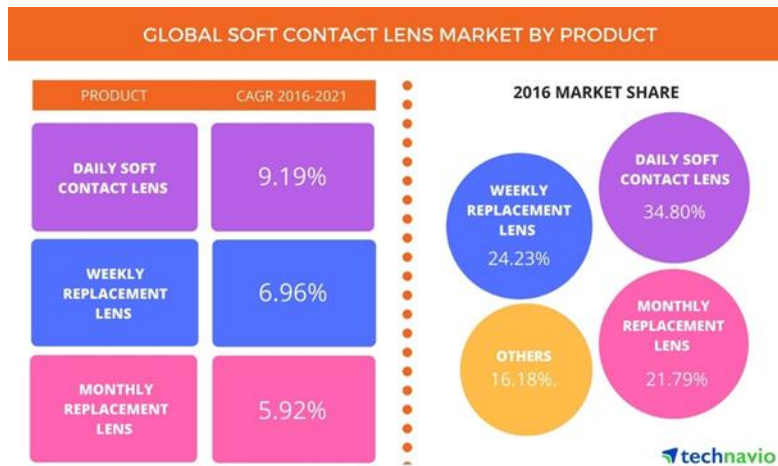


Figure 1. Consumption of soft contact lenses by products worldwide^{xvi}



Figure 2. Contact lens users in Europe by country (%)^{xvii}

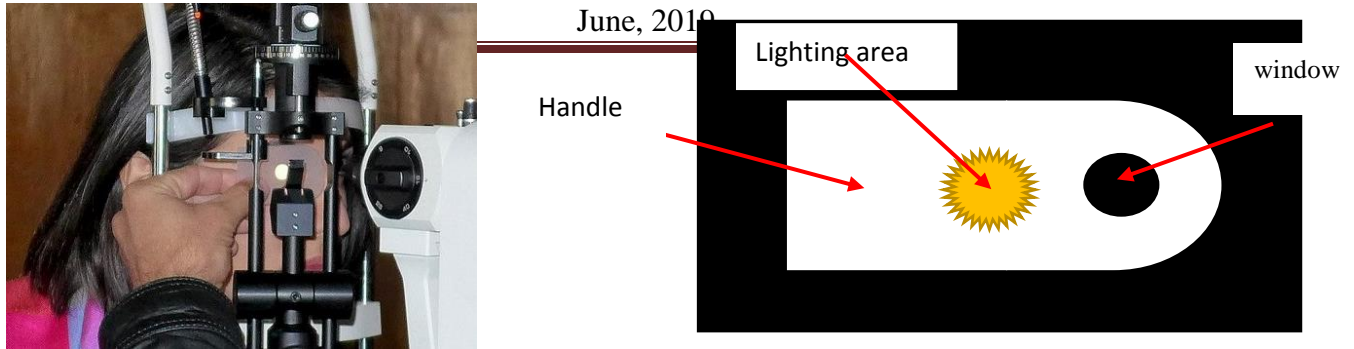
2. OBJECTIVES AND TASKS

Objective: To determine the relationship between silicone - hydrogel materials used to make daily disposable contact lenses and their wetting *in vivo*.

As a subject of study, the following SiHy contact lenses were selected with a completely different wetting mechanism: delefilcon A, narafilcon A, Determination of the wetting of contact lenses *in vivo* by specular microscopy.

3. MATERIALS AND METHODS

A biomicroscope and modified specular microscopy with a filter was used to evaluate the wetting^{xviii}. This is a non-invasive method, when the distance between the filter and the eye being extremely important, as well as the intensity of the light.



Each of the contact lens materials delefilcon A, narafilcon A, has a different strategy to ensure good wetting. Some of these are: a water gradient, a low total silicone content in the lens, and further wetting agents incorporated in the lens.

With this method, any type of soft contact lens for good wetting can be investigated.

Even with similar parameters like diopter, base curvature, diameter, center thickness, the interaction of the tear film with the contact lens may be different, resulting in poor wear comfort and even worsening clarity of vision.

4. RESULTS

To evaluate the wetting, an evaluation scale^{xix} obtained with a high magnification and low illumination was used (Grade 0 = excellent and 4 = Poor)

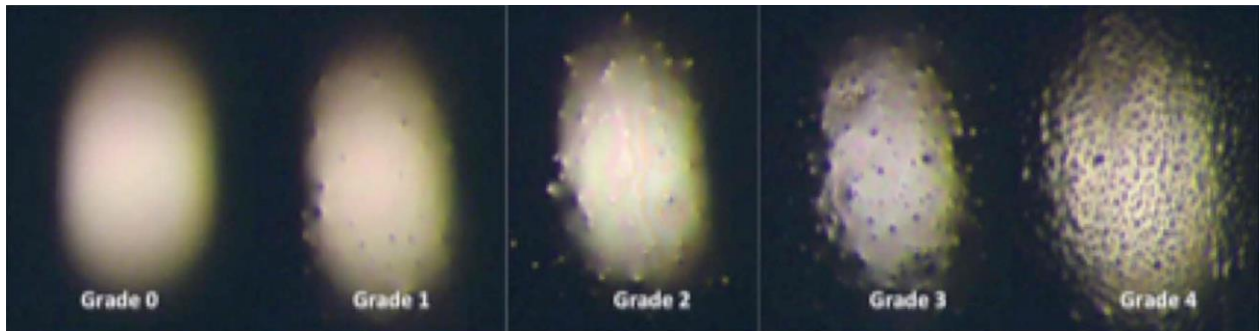
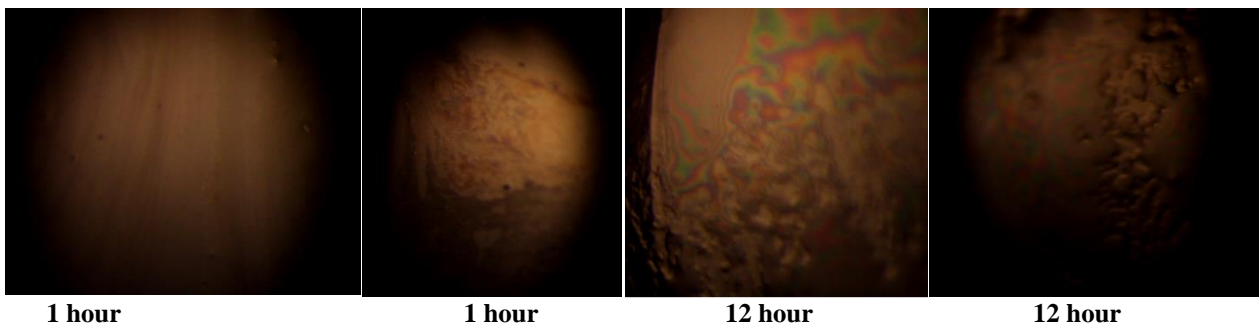


Figure 3. Scale for subjective assessment of wetting of CL

One patient was fitted with each of the various materials of daily disposable silicone-hydrogel contact lenses. It turned out that besides standard fitting methods, wetting was extremely important for carrying comfort.



What the data show is that for each of the four types of CL one hour after the placement, the tear film shows good flow, good dynamics of reorganization, 1-1.5 seconds after blinking, it achieves a stable morphology and a good lifespan of the tear film, i.e. over ten seconds there is no rupture on the outer surface of the eye. After twelve hours of wear, however, there are significant differences in the behavior, morphology and stability of the tear film.

5. CONCLUSION

The key to good wetting on the one hand is the type of strategy used in the given material, and on the other hand the difference in the tear film of each patient.

The wetting of the contact lenses is a parameter that should not be overlooked if we want to make it most comfortable. The modified specimen microscopy method makes the evaluation quick and easy.

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