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Analysis of Polish eye care professionals' opinions about deposits on contact lenses

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HIGHLIGHTS

Polish eye care professionals believe that different silicone-hydrogel lenses vary in their resistance to lipid deposits, and this resistance is important to them when selecting a product for a patient.

ABSTRACT

Soft contact lenses are used worldwide to correct ametropia. This medical device should be fitted and systematically evaluated on the patient eye by eye care professionals. The examination should include an evaluation of lens deposits. The widespread use of silicone hydrogel (Si-Hy) lenses and their tendency to build up lipid deposits indicate that eye care professionals should pay special attention to this kind of deposits. This paper aims to analyze the opinions of Polish ECPs regarding deposits on contact lenses, particularly regarding lipids and Si-Hy lenses. Data were collected from 103 Polish eye care professionals through an online survey. Respondents reported that lipid deposits are most often present on Si-Hy lenses, and protein deposits occur most often on hydrogel lenses. Almost all of them declare that they evaluate deposits on contact lenses on follow-up visits, which concludes that this is an essential part of the lens selection process for them. Respondents believe that different lenses and lens care solutions vary in the context of their interaction with lipid deposits. These parameters should be considered at the time of product selection. Eye care professionals expect descriptions of lenses' resistance to lipid deposits, and care solution effectiveness in reducing lipid deposits.

Key words: contact lenses, contact lens deposits, silicone-hydrogel contact lenses, contact lens discomfort

INTRODUCTION

Contact lenses are a common method of correcting refractive errors in the eye, used throughout the world. A report from 24 markets around the globe shows that eye care professionals (ECPs) most often fit soft lenses (82% of fits in 2020), while silicon-hydrogel (Si-Hy) lenses are responsible for 59% of fits [1]. Contact lenses work in direct contact with the patient's eye. Therefore, they perform on the surface of the eye and are surrounded by the tear film. The tear film composition is water and substances such as mucins, lipids, proteins, and electrolytes. The main lipid components of tears (mol%) are cholesterol-ester, wax ester, and cholesterol [2]. Over 1500 proteins can be found in the tear film [3]. A modern approach describes the tear film as a single dynamic functional unit with different compartments, changing the old definition of the tear film as a three-layer film (mucin, water, lipid) and introducing the 'interlacing layers' concept [4, 5].

Contact lenses are exposed to endogenous deposits, both proteins and lipids, when performing in a complex environment of the eye [6]. Studies found that Si-Hy lenses accumulate more lipid deposits when compared to hydrogel lenses which accumulate more proteins [7, 8]. Consequently, the interactions between lipids and the Si-Hy lenses are important. Recently, Sulinski and Pniewski reported in a review paper on the subject that:

- Different Si-Hy lens materials exhibited different properties for lipid deposits, which could result from the specific properties of the polymers or the surface treatment.
- There is no standard method to assess the amount of lipid deposits in Si-Hy lenses.
- The effects of lipid deposits on Si-Hy lenses on patients' clinical response, particularly their impact on discomfort, are not fully understood [9].

The role of the ECPs in the contact lens fitting process is to ensure the patient's vision, comfort, and safety. Regular follow-up visits are required to assess both the patient's eye health and the condition of the lenses, including deposit evaluation [10].

PURPOSE

This study aims to analyze the opinions of Polish ECPs on the subject of deposits on contact lenses, particularly regarding lipids and Si-Hy lenses.

METHODS

Data were collected via an online survey. The criteria for participation were:

- age 18 years or more
- conscientious consent to participate in the study
- confirmation that the respondent is responsible for contact lens fitting in his/her work.

In total, 104 responses were collected. One interviewee did not fulfill the above criteria, so his/her answers were not used in the study. Finally, the study analyzes data from 103 respondents.

Survey respondents were supposed to answer 5 demographic questions and 13 questions related to the survey topic.

A total of 73 women and 30 men responded. The mean age was 34.64 years, while the youngest respondent was 24 and the oldest 62. Respondents declared that they held the titles of optician (n = 1), optometry student (n = 9), ophthalmologist (n = 15), or optometrist (n = 78). Most of them have practiced in large towns (fig. 1), and 59% of the professionals surveyed had at least 5 years of lens fitting experience (fig. 2).

FIGURE 1

Declaration of the size of the city in which the respondents practice.

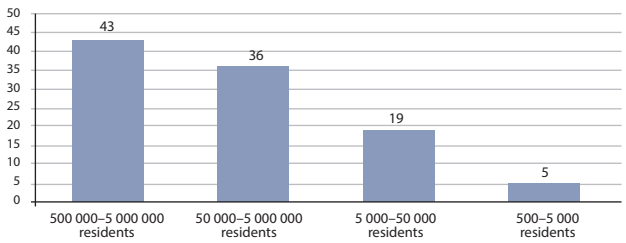
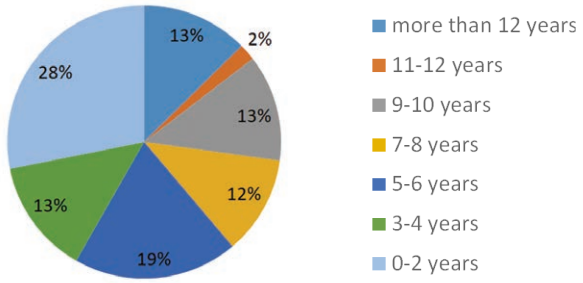


FIGURE 2

The surveyed professionals' experience in lens fitting (years).



RESULTS

Table 1 lists the topic questions used in the survey.

TABLE 1

List of questions and possible answers in the survey.

No.	Question	Answers to choose from
1	In your opinion, what types of deposits are most likely to appear on reusable-hydrogel contact lenses?	• Protein • Lipid • They have no deposits • Other_____
2	In your opinion, what type of deposits are most likely to appear on reusable silicone-hydrogel contact lenses?	• Protein • Lipid • They have no deposits • Other_____
3	In your opinion, what type of deposits are most likely to appear on hydrogel daily disposable contact lenses?	• Protein • Lipid • They have no deposits • Other_____
4	In your opinion, what type of deposits are most likely to appear on silicone-hydrogel daily disposable contact lenses?	• Protein • Lipid • They have no deposits • Other_____
5	Do you evaluate deposits on contact lenses at follow-up visits?	• Yes, always • Yes, but only in some cases • Yes, in most cases • No
6	What is the impact of lipid deposits on contact lens comfort?	• Always lead to a discomfort • Sometimes they lead to a discomfort • Do not affect the comfort • Enhance the comfort
7	What is the impact of lipid deposits on contact lens vision quality?	• Always lead to a reduced quality of vision • Sometimes lead to a reduced quality of vision • Do not affect the quality of vision • Enhance the quality of vision
8	Do you agree that different silicone-hydrogel lens materials have different resistance to lipid deposits?	• Strongly agree • Yes, but the differences are minor • Do not know • No
9	Does lens material resistance to lipid deposits matter to you in the process of selecting a lens for a patient?	• Strongly agree • Yes • I do not have an opinion • No • Definitely no
10	Should lenses be described by manufacturers according to resistance to lipid deposits?	• Strongly agree • Yes • I do not have an opinion • No • Definitely no
11	Do you agree that different contact lens solutions have different efficacy in reducing lipid deposits?	• Strongly agree • Yes, but the differences are minor • Do not know • No
12	Does lipid deposit reduction efficacy matter to you when selecting a lens care solution for a patient?	• Strongly agree • Yes • I do not have an opinion • No • Definitely no
13	Should lens care solutions be described by manufacturers according to their effectiveness in reducing lipid deposits?	• Strongly agree • Yes • I do not have an opinion • No • Definitely no

The questions 1–4 were related to the most common deposits on different types of contact lenses. The summary of the answers is collected in table 2.

In the answers to the question 5, 26% of professionals reported that they always evaluate deposits on contact lenses during follow-up visits, 40% do it in most cases, 28% only in some cases, and 6% declared that they never do it.

The questions 6–7 explored respondents' opinions concerning the impact of lipid deposits on the comfort and quality of vision (tab. 3).

Subsequently, 82% of professionals agree that different Si-Hy lens materials have diverse resistance to lipid deposits, with 47% believing the differences are minor (fig. 3). 47% of respondents declare that lens material resistance to lipid deposits is an essential parameter in the process of selecting a lens for a patient (fig. 4). 67% of Polish ECPs think that manufacturers should describe lenses according to resistance to lipid deposits (fig. 5).

Then, 88% of the professionals agree that different contact lens solutions have diverse efficacy in reducing lipid deposits, while 58% strongly agree (fig. 6). 65% of the respondents declare that the efficacy of lipid deposits reduction is an important parameter in selecting a lens care solution (fig. 7). 82% of Polish ECPs think that lens care solutions should be described by manufacturers according to their effectiveness in reducing lipid deposits (fig. 8).

FIGURE 3

Percentage of the respondents' answers to the question 8.

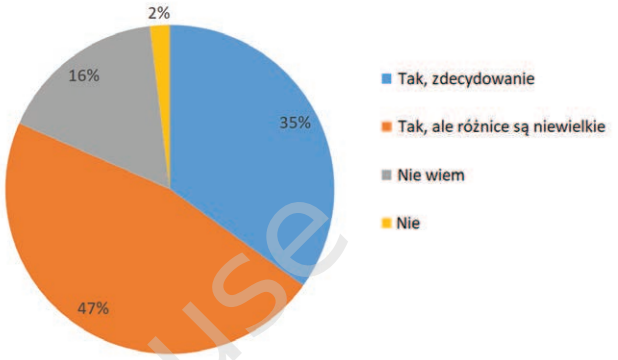


FIGURE 4

Percentage of the respondents' answers to the question 9.

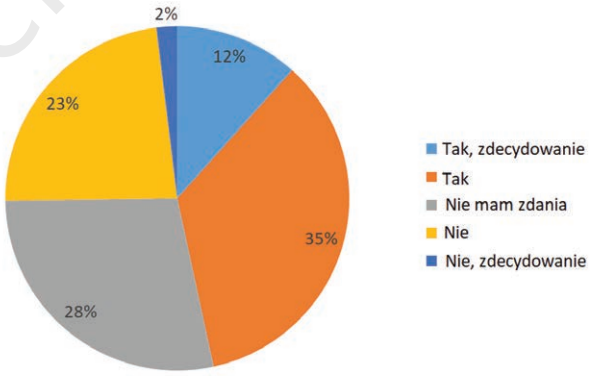


TABLE 2

Collected survey results (% response, and others) for the questions 1–4.

Replacement mode	Daily		Reusable	
Material	**hydrogel**	**Si-Hy**	**hydrogel**	**Si-Hy**
Protein	**45%**	13%	**71%**	22%
Lipid	18%	**49%**	21%	**69%**
No deposits	34%	34%	7%	8%
Other answers	• Depends on the patient • Make-up	• Depends on the patient • Do not know • Make-up • Very rarely, but sometimes, lipid deposits occur	• Does not fit hydrogels	• Make-up

TABLE 3

Collected results (% response) about professionals' opinions concerning the impact of lipid deposits on the comfort and quality of vision (the questions 6–7).

Answer	Rate	Answer	Rate
Always lead to a discomfort	9%	Always lead to a reduced quality of vision	18%
Sometimes lead to a discomfort	**83%**	Sometimes lead to a reduced quality of vision	**75%**
Do not affect the comfort	8%	Do not affect the quality of vision	7%

FIGURE 5

Percentage of the respondents' answers to the question 10.

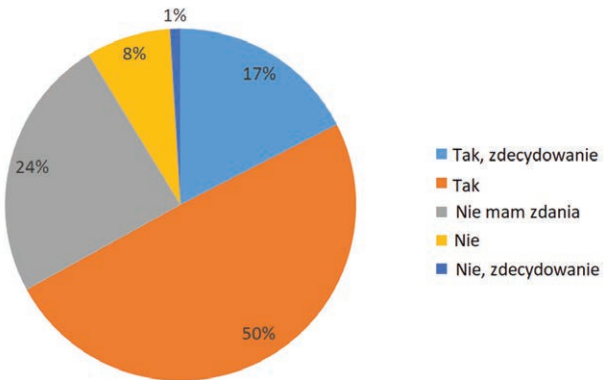


FIGURE 6

Percentage of the respondents' answers to the question 11.

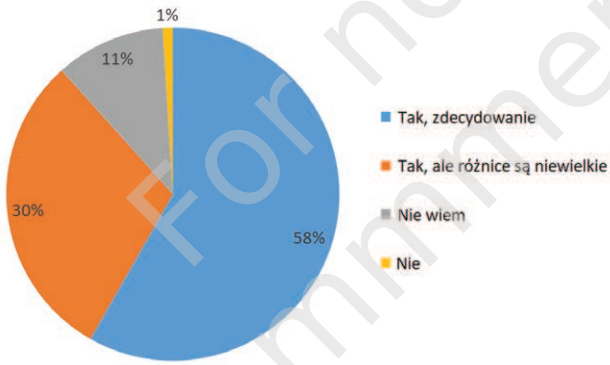


FIGURE 7

Procentowy udział odpowiedzi respondentów na pytanie 12.

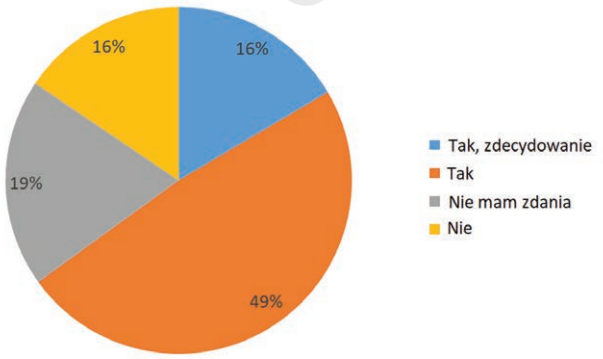
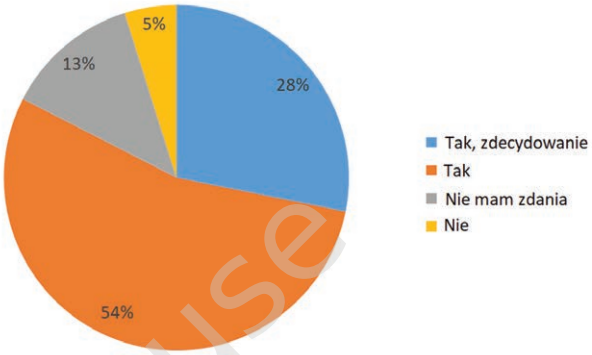


FIGURE 8

Procentowy udział odpowiedzi respondentów na pytanie 13.



DISCUSSION

The responses of Polish ECPs regarding the occurrence of different types of deposits on various lens materials are in line with literature data. It can be seen from table 2 that lipid deposits are reported as most often present on Si-Hy lenses, and protein deposits are reported as occurring most often on hydrogel lenses. However, more respondents indicate the appearance of such deposits on reusable lenses than on daily disposable lenses. For daily disposable lenses, 34% of ECPs report no deposits, which agrees with the practical approach that if deposits occur on reusable lenses, switching to daily disposable lenses should be considered [11]. For most lens types, there were also responses identifying makeup as a type of deposit, which was also mentioned in other publications [12–14].

The follow-up visit is an integral part of the contact lens fitting process. It is included in the "Standard Optometric Examination and Contact Lens Fitting" issued by the Polish Society of Optometry and Optics and Polish Contact Lens Asosiacion. Lens evaluation was identified as one of the steps in this visit [15]. Only 6% of the respondents stated that they did not assess lens deposits at the follow-up visit, suggesting that this is a commonly used procedure in the lens fitting.

The survey results show that Polish ECPs consider lipid deposits a potential source of contact lens discomfort, with the vast majority believing it only happens occasionally. Only 8% of respondents think that lipid deposits do not affect comfort at all (tab. 3). However, a direct evidence that lipid deposits can cause discomfort is not supported in the literature [9]. The majority of respondents also stated that lipid deposits could lead to a reduced quality of vision (tab. 3).

Most of the professionals surveyed (82%) agree that different Si-Hy lens materials have diverse resistance to lipid deposits. However, 47% believe that the differences are minor, which contrasts with the literature information that indicates a wide variation in the amount of lipid deposits for different lens materials and surface treatment [7, 16–20]. Even more professionals agree (88%) that different contact lens solutions have different efficacy in reducing lipid deposits, where 58% declared that they strongly agree. The literature data support these opinions [21].

For the analysis of the questions 9, 10, 12, 13, "I do not have an opinion" responses were excluded. 65% of the respondents (n = 74) stated that lens material resistance to lipid deposits is crucial for selecting a lens for a patient. Even more, 81% (n = 83) reported that lipid deposit reduction efficacy is important when selecting a care solution for a patient. 89% of Polish ECPs (n = 78) think that manufacturers should describe lenses according to resistance to lipid deposits, and 94% (n = 90) stated that manufacturers should describe lens care solutions according to their effectiveness in reducing lipid deposits.

CONCLUSIONS

Polish ECPs believe that deposit assessment is an essential step in the contact lens fitting process. Their observations of the types of deposits on each sort of lenses are consistent with the data in the literature. Both the literature data and responses from this survey do not clearly indicate a connection between lipid deposits on the appearance of discomfort and a decrease in the quality of vision. Respondents believe that different lenses and lens care solutions vary in the context of their interaction with lipid deposits. Moreover, these parameters should be considered at the time of product selection. Moreover, this is more important for them with care solutions selecting. Finally, the manufacturers should provide an information on lenses' resistance to lipid deposits and care solution effectiveness in reducing lipid deposits.

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References

1. Morgan PB, Woods CA, Tranoudis IG et al. International contact lens prescribing in 2020. Contact Lens Spectr. 2021: 32-8.
2. Millar TJ, Schuett BS. The real reason for having a meibomian lipid layer covering the outer surface of the tear film – A review. Exp Eye Res. 2015; 137: 125-38. http://doi.org/10.1016/j.exer.2015.05.002.
3. Zhou L, Zhao SZ, Koh SK et al. In-depth analysis of the human tear proteome. J Proteomics. 2012; 75(13): 3877-85. http://doi.org/10.1016/J.JPROT.2012.04.053.
4. Yokoi N, Bron AJ, Georgiev GA. The precorneal tear film as a fluid shell: The effect of blinking and saccades on tear film distribution and dynamics. Ocul Surf. 2014; 12(4): 252-66. http://doi.org/10.1016/j.jtos.2014.01.006.
5. McCulley JP, Shine W. A compositional based model for the tear film lipid layer. Trans Am Ophthalmol Soc. 1997; 95: 79-88; discussion 88-93.
6. Mann A, Tighe B. Contact lens interactions with the tear film. Exp Eye Res. 2013; 117: 88-98. http://doi.org/10.1016/j.exer.2013.07.013.
7. Cheung SW, Cho P, Chan B et al. A comparative study of biweekly disposable contact lenses: Silicone hydrogel versus hydrogel. Clin Exp Optom. 2007; 90(2): 124-31. http://doi.org/10.1111/j.1444-0938.2006.00107.x.
8. Nichols JJ. Deposition on silicone hydrogel lenses. Eye Contact Lens 2013: 39: 20-3. http://doi.org/10.1097/ICL.0b013e318275305b.
9. Suliński T, Pniewski J. Interaction of silicone hydrogel contact lenses with lipids – a chronological review. OphthaTherapy. 2020; 7(4): 306-25. http://doi.org/10.24292/01.OT.311220.A.
10. Efron N. History. In: Efron N. Contact Lens Practice. 2018; 3-9.e1. http://doi.org/10.1016/b978-0-7020-6660-3.00001-0.
11. Wagner H. The How and Why of Contact Lens Deposits. Review of Cornea & Contact Lens. Published 2020. https://www.reviewofcontactlenses.com/article/the-how-and-why-of-contact-lens-deposits.
12. Tsukiyama J, Miyamoto Y, Fukuda M et al. Influence of Cosmetic and Cleansing Products for the Eyes on Soft Contact Lenses. IOVS. ARVO Journals. Published 2010. https://iovs.arvojournals.org/article.aspx?articleid=2368008 (access: 22.10.2021).
13. Tavazzi S, Rossi A, Picarazzi S et. Polymer-interaction driven diffusionof eyeshadow in soft contact lenses. Contact Lens Anterior Eye. 2017; 40(5): 335-9. http://doi.org/10.1016/j.clae.2017.06.003.
14. Luensmann D, Yu M, Yang J et al. Impact of cosmetics on the physical dimension and optical performance of silicone hydrogel contact lenses. Eye Contact Lens. 2015; 41(4): 218-27. http://doi.org/10.1097/ICL.0000000000000109.
15. Standard badania optometrycznego i dopasowania soczewek kontaktowych. http://ptoo.pl/standard-badania (access: 22.10.2021).
16. Jones L, Senchyna M, Glasier MA et al. Lysozyme and lipid deposition on silicone hydrogel contact lens materials. Eye Contact Lens. 2003; 29(suppl 1): S75-9. http://doi.org/10.1097/00140068-200301001-00021.
17. Maziarz EP, Stachowski MJ, Liu XM et al. Lipid Deposition on Silicone Hydrogel Lenses, Part I: Quantification of Oleic Acid, Oleic Acid Methyl Ester, and Cholesterol. Eye Contact Lens Sci Clin Pract. 2006; 32(6): 300-7. http://doi.org/10.1097/01.icl.0000224365.51872.6c.
18. Nash WL, Gabriel MM. Ex vivo analysis of cholesterol deposition for commercially available silicone hydrogel contact lenses using a fluorometric enzymatic assay. Eye Contact Lens. 2014; 40(5): 277-82. http://doi.org/10.1097/ICL.0000000000000052.
19. Nash W, Gabriel MM, Mowrey-McKee M. A comparison of various silicone hydrogel lenses; Lipid and protein deposition as a result of daily wear. American Academy of Ophthalmology (AAO); 2010. https://www.aaopt.org/detail/knowledge-base-article/comparison--various-silicone-hydrogel-lenses-lipid-and-protein-deposition-result-daily-wear (access: 22.10.2021).
20. Luensmann D, Omali NB, Suko A et al. Kinetic Deposition of Polar and Non-polar Lipids on Silicone Hydrogel Contact Lenses. Curr Eye Res. Published online 2020. http://doi.org/10.1080/02713683.2020.1755696.
21. Shows A, Redfern RL, Sickenberger W et al. Lipid Analysis on Block Copolymer-containing Packaging Solution and Lens Care Regimens: A Randomized Clinical Trial. Optom Vis Sci. 2020; 97(8): 565-72. http://doi.org/10.1097/OPX.0000000000001553.

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All authors contributed equally to the article.

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Tomasz Suliński is an employee of the Alcon;
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