Comparison of Vision-Related Quality of Life between Children and Young Adults Wearing Orthokeratology and Soft Contact Lenses

Comparação da Qualidade de Vida Relacionada com a Visão entre Crianças e Jovens Adultos que Usam Ortoqueratologia e Lentes de Contato Gelatinosas

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ABSTRACT

INTRODUCTION: This study compared vision-related quality of life (QoL) in children and young adults with myopia who were established soft contact lenses (SCL), and orthokeratology (OK) wearers using the Orthokeratology and Contact Lens Quality of Life questionnaire (OCL-QoL).

METHODS: Sixty-two subjects (32 young adults aged 18–26 years and 30 children aged 9–17 years) completed the OCL-QoL. Subjects must have worn either SCL or OK as their primary correction for at least three years. Rasch-scaled scores were compared between age groups and lens correction modality groups using Mann-Whitney U tests.

RESULTS: The average age (± standard deviation) of adult subjects was 21.8 ± 2.5 years and 14.5 ± 1.9 years for children. Overall, adults reported higher (better) scores on the OCL-QoL compared to children in (p = 0.005). This difference was primarily driven by questions related to contact lens insertion, vision and cognition, and concern for eye injuries, where children reported lower scores. There was no difference in scores between SCL versus OK wearers (p = 0.82).

CONCLUSION: Young adults and children who have been wearing contact lenses for at least three years are generally satisfied with their chosen contact lens correction modality. Quality of life scores for adults were generally better than children, perhaps due to the types of questions asked in the OCL-QoL. Practitioners should explain the benefits of both OK and SCL to their patients with myopia. Researchers should consider that scores for children and adults may differ depending on the survey.

KEYWORDS: Child; Contact Lenses; Myopia/therapy; Orthokeratologic Procedures; Quality of Life; Surveys and Questionnaires; Young Adult.

RESUMO

INTRODUÇÃO: Este estudo comparou a qualidade de vida relacionada com a visão (QdV) em crianças e jovens adultos com miopia que usavam lentes de contacto gelatinosas (LSC) e ortoqueratologia (OK), utilizando o questionário Ortoqueratologia e Qualidade de Vida com Lentes de Contacto (OCL-QoL).

MÉTODOS: Sessenta e dois indivíduos (32 jovens adultos com idades entre os 18 e os 26 anos e 30 crianças com idades entre os 9 e os 17 anos) preencheram o OCL-QoL. Os sujeitos deviam ter usado SCL ou OK como correção primária durante pelo menos três anos. As pontuações da escala Rasch foram comparadas entre grupos etários e grupos de modalidades de correção da lente utilizando os testes U de Mann-Whitney.

RESULTADOS: A idade média (± desvio padrão) dos indivíduos adultos foi de 21,8 ± 2,5 anos e de 14,5 ± 1,9 anos para as crianças. Em geral, os adultos referiram pontuações mais elevadas (melhores) no OCL-QoL em comparação com as crianças (p = 0,005). Esta diferença deveu-se principalmente a questões relacionadas com a inserção de lentes de contacto, visão e cognição, e preocupação com lesões oculares, em que as crianças relataram pontuações mais baixas. Não houve diferença nas pontuações entre utilizadores de SCL e OK (p = 0,82).

CONCLUSÃO: Os jovens adultos e as crianças que usam lentes de contacto há pelo menos três anos estão geralmente satisfeitos com a modalidade de correção de lentes de contacto que escolheram. Os resultados da qualidade de vida dos adultos foram geralmente melhores do que os das crianças, talvez devido ao tipo de perguntas feitas no OCL-QoL. Os médicos devem explicar aos seus pacientes os benefícios das lentes de contacto OK e SCL com miopia. Os investigadores devem considerar que as pontuações para crianças e adultos podem diferir dependendo do inquérito.

PALAVRAS-CHAVE: Adulto Jovem; Criança; Inquéritos e Questionários; Lentes de Contacto; Miopia/tratamento; Procedimentos Ortoqueratológicos; Qualidade de Vida.

INTRODUCTION

Patients with regular myopia primarily wear glasses, soft contact lenses (SCL), or orthokeratology (OK), to correct their vision, with a minority of patients wearing rigid or scleral lenses.[1–5] It is important for eye care practitioners and clinical researchers to understand how these corrections affect not just visual acuity, but also vision-related quality of life (QoL). Clinically, patients can have identical objective visual findings but report very different perceptual outcomes.[6]

Our previous study in children reported better vision-related QoL with SCL and OK compared to glasses (GL) using the PREP questionnaire.[7] Other studies in adults have also reported preference for OK over SCL.[8–11] Past studies included either neophyte contact lens wearers or had a cross sectional study design where subjects wore contact lenses for six months or less. The inclusion of neophyte contact lens wearers may have an impact on assessment of vision-related QoL due to adaptations issues and the novelty of the correction.[12,13] In established wearers, studies have shown many factors contribute to contact lens dissatisfaction, including poor or fluctuating vision, discomfort/dryness, and lack of convenience or increased cost.[14]

New surveys can improve our understanding of patient-reported outcomes.[15] Questionnaires based on Rasch methods are often recognized as superior since they contain summary scoring and weighted items methods.[16–18] The Orthokeratology and Contact Lens Quality of Life (OCL-QoL) is a validated questionnaire for assessing vision-related QoL and was developed with the aid of Rasch analysis.[11] The OCL-QoL was specifically designed to assess a variety of QoL concerns in children and adults wearing contact lenses, including OK. The purpose of this study was to investigate differences in vision related QoL for children and young adults who were established wearers of SCL or OK for correction of myopia.

METHODS

This single visit cross-sectional study was conducted at the University of Houston College of Optometry between June 2019 to May 2021. The study was originally conducted on campus and was transitioned to virtual visits via Zoom Video (Zoom Video Communications, Inc. San Jose, CA) due to the COVID-19 pandemic. Online surveys were performed via Google Forms (Google, Mountain View, CA). The study followed the tenets of the Declaration of Helsinki and received Institutional Review Board approval from the University of Houston. Each adult, child, and parent of child received both a written and verbal explanation of the study procedures. All participants provided voluntary informed assent/consent prior to enrollment. Subjects under the age of 18 (i.e. age 9 to 17, inclusive) provided assent and a parent or designated legal guardian provided consent.

SUBJECTS

Subjects were recruited from patients, faculty, students, and staff of the University Eye Institute/University of Houston College of Optometry, as well as the surrounding community via verbal communication, print media, telephone, and electronic media. Children 9 to 17 years (inclusive) and young adults 18 to 26 years (inclusive) were recruited. Subjects were required to have self-reported good vision in each eye and more than 3 years of routine (i.e. at least 5 days per week) wear with either daily disposable or re-useable SCL or OK lenses. Those wearing SCL were required to have a refractive error of plano to -6.00 D vertex corrected myopia and up to -1.75 D (inclusive) vertex corrected astigmatism, in order to align with OK wearers. Subjects were excluded if they had ocular allergy more than mild, dry eye disease more than mild, reported current use of any other ocular medications (other than artificial tears), current or previous use of Accutane or any history of malformation, surgery or injury which caused permanent damage to the ocular surface, as well as if they were pregnant or lactating.

QUESTIONNAIRE

All subjects completed the Orthokeratology and Contact Lens Quality of Life (OCL-QoL). The OCL-QoL consists of 23 symptom-based question items. The questionnaire is scored from 0 to 100, with higher scores indicating better quality of life (Table 1).

STATISTICAL ANALYSIS

The data were entered into an Excel (Microsoft Redmond, Washington) spreadsheet and checked for outliers and missing data. The data were analyzed using R (R Foundation for Statistical Computing, https://www.R-project.org). Demographic data were examined using unpaired t-tests and Chi-square tests. Rasch scores were calculated per the questionnaire guidelines. Mann-Whitney U tests were used to compare scores between age groups and correction types. *P*-values less than 0.05 were considered significant unless otherwise stated.

RESULTS

Sixty-two myopes (30 SCL; 32 OK) were enrolled and the OCL-QoL. Thirty-two were young adults and 30 were children. Demographics by age group and modality of lens wear are shown in Table 2. As expected, adults were older and wore their correction for a longer average duration compared to children ($p < 0.001$). Between correction modalities, there was a higher proportion of Asian subjects wearing OK lenses ($p = 0.005$). There were no other significant differences between correction or age groups.

Table 1. Grading of OCL-Qo.

Survey	Score Interpretation	Grading Scales		
OCL-QoL	Higher = Better Quality of Life	Very satisfied (3)	Very good (3)	None (2)
		Somewhat satisfied (2)	Good (2)	A little (1)
		Somewhat dissatisfied (1)	Poor (1)	A lot (0)
		Very dissatisfied (0)	Very poor (0)	

Table 2. Study demographics by correction and age group.

	Adults			Children			*p*-value A *vs* C	*p*-value SCL *vs* OK
	SCL (n=16)	OK (n=16)	All adults (n = 32)	SCL (n=14)	OK (n=16)	All children (N = 30)		
Age (years)	22.5 ± 2.0	21.1 ± 2.7	21.8 ± 2.5	15.5±1.3	13.6 ± 2.0	14.5 ± 1.9	**<0.001**	0.08
Mean ± SD (Range)	(18 – 26)	(18 – 26)	(18 – 26)	(13 – 17)	(10 – 17)	(13 – 17)		
Sex n (%)							0.92	0.08
Female	12 (75%)	10 (63%)	22 (69%)	12 (86%)	9 (56%)	21 (70%)		
Male	4 (25%)	6 (37%)	10 (31%)	2 (14%)	7 (44%)	9 (30%)		
Race n (%)							0.50	**0.005**
White	10 (63%)	6 (38%)	16 (50%)	10 (71%)	5 (31%)	15 (50%)		
Asian	5 (31%)	9 (56%)	14 (44%)	0 (0%)	9 (56%)	9 (30%)		
Black	1 (6%)	0 (0%)	1 (3%)	2 (14%)	0 (0%)	2 (7%)		
AI/AN	0 (0%)	1 (6%)	1 (3%)	1 (7%)	2 (13%)	3 (10%)		
Pacific Islander	0 (0%)	0 (0%)	0 (0%)	1 (7%)	0 (0%)	1 (3%)		
Ethnicity n (%)							0.93	0.35
Hispanic	2 (13%)	1 (6%)	3 (9%)	2 (13%)	1 (6%)	3 (10%)		
Non-Hispanic	14 (88%)	15 (94%)	29 (91%)	12 (86%)	15 (94%)	27 (9%)		
Duration of wear (years)	8.3 ± 2.8	7.9 ± 3.5	8.1 ± 2.5	4.1 ± 1.6	5.3 ± 2.6	4.8 ± 2.2	**<0.001**	0.72
Mean±SD (Range)	(3 – 13)	(3 – 13)	(3 – 13)	(3 – 8)	(3 – 11)	(3 – 11)		

SD: standard deviation; A: adult; C: ahildren; SCL: soft contact lens; OK: orthokeratology; AI/AN: American Indian/Alaskan Native; **Bold: *p*<0.05**.

Table 3. OCL-QoL Rasch-scaled scores by age group and correction. A higher score indicates better QoL.

	Adults			Children			*p*-value A *vs* C	*p*-value SCL *vs* OK
	SCL (n=16)	OK (n=16)	All adults (n = 32)	SCL (n=14)	OK (n=16)	All children (N = 30)		
Overall Score	49.1	54.3	51.5	37.1	41.7	38.9	**0.005**	0.82
Median (IQR)	(46.3 – 56.4)	(39.1 – 59.2)	(44.3 – 58.2)	(34.4 – 43.0)	(36.0 – 51.2)	(34.4 – 49.6)		

IQR: inter-quartile range; A: adult; C: ahildren; SCL: soft contact lens; OK: orthokeratology; **Bold: $p<0.05$**.

Overall, adults reported better QoL (12.6 points higher) compared to children (p = 0.005, Table 3). Adults wearing SCL reported better QoL (12 points higher) than children (p = 0.009), but there was no significant difference between adults and children wearing OK (p = 0.10). There was also no difference in QoL between SCL and OK wearers overall (p = 0.82), or by age subgroup (p > 0.62)

To understand which questions were driving the difference by age, post-hoc Mann-Whitney U tests were performed for the individual questions. Due to multiple comparisons, the Benjamini-Hochberg corrected level of significance was calculated to be p < 0.007. Three questions met this stricter criterion. On average, children reported more problems (lower scores) with the insertion of contact lenses (question 6, median 1.0 *vs* 1.5, p = 0.003), problems related to their vision and cognition (question 14, median 0.5 *vs* 2.0, p = 0.009) and concern for eye injuries (question 23, median 1.0 *vs* 2.0, p = 0.002).

DISCUSSION

This study investigated vision-related QoL in children and adults wearing SCL or OK for at least 3 years, using a validated quality of life instrument, the OCL-QoL. The main finding of the study was that adults reported higher (better) scores than children; or, conversely children reported lower (worse) scores than adults taking the OCL-QoL.

Development of the OCL-QoL included children and adults. However, the OCL-QoL includes questions about cost, handling, and convenience which may not have the same meaning for children as adults. The questions that drove the disparity in the overall score for this group were related to the insertion of contact lenses, problems related to their vision and cognition and concern for eye injuries (p<0.007 [p-value corrected for multiple comparisons]).

This is the first study that used the OCL-QoL since its published development in 2018. Although this study found no statistically significant differences in vision-related QoL between SCL and OK based on the OCL-QoL, this study still provides a valuable understanding of vision related QoL in patients' chosen habitual correction. Previous studies in adults have reported preference for OK over SCL.[8–10] It is important to note that comparison between this study and previous QoL studies may be difficult to make due to the fact that previous studies used questionnaires that were not validated for OK or for use with children. In addition, results of this study may differ from previous studies because this study enrolled established wearers instead of neophytes. Initial improvement in vision related QoL may be secondary to a novelty effect.[12,13] These earlier studies which reported improvements in QoL for SCL or OK over habitual glasses correction observed a plateau effect after initial wear.

This is the first study to compare established SCL and OK wearing children and young adults using a survey instrument that has been validated for children and adults as well as for OK. A limitation of this study is the generally small number of subjects. Also, this study did not detect significant changes between each modality, which may be due to the need for a larger sample size. Future studies should include both new wearers and established wearers to be able to make direct comparisons in QoL scores.

CONCLUSION

In conclusion, this study found that adults appear to report better vision related QoL than children. Therefore, it is important to consider age-related differences when assessing QoL in children and young adults. Overall, adults and children who are established SCL and OK wearers appear equally satisfied with their chosen vision correction. These findings should be taken into consideration when planning studies and offering myopic correction options for children and adults.

CONTRIBUTORSHIP STATEMENT / DECLARAÇÃO DE CONTRIBUIÇÃO

KD: Data analysis, manuscript writing.

LL: Data collection, study design, data analysis, editing.

CC: Data Collection, Data analysis, manuscript review.

ML: Study design, data analysis, paper writing, paper review.

CM: Study design, supervision, data analysis, input to paper writing/editing, critical review of paper.

KR: Study design, data collection, data analysis, paper writing, paper review.

All authors approved the final version to be published.

KD: Análise de dados, redação do manuscrito.

LL: Recolha de dados, conceção do estudo, análise de dados, edição.

CC: Recolha de dados, análise de dados, revisão do manuscrito.

ML: Conceção do estudo, análise de dados, redação do artigo, revisão do artigo.

CM: Conceção do estudo, supervisão, análise de dados, contribuição para a redação/edição do artigo, revisão crítica do artigo.

KR: Conceção do estudo, recolha de dados, análise de dados, redação do artigo, revisão do artigo.

Todos os autores aprovaram a versão final a ser publicada.

RESPONSABILIDADES ÉTICAS

Conflitos de Interesse: Os autores declaram a existência de conflitos de interesse.

Fontes de Financiamento: Este estudo foi apoiado pelos NIH-NEI T35 e P30 (EY007099, EY007551, PI Laura Frishman), a Paragon Vision Sciences forneceu apoio.

Confidencialidade dos Dados: Os autores declaram ter seguido os protocolos da sua instituição acerca da publicação dos dados de doentes.

Proteção de Pessoas e Animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pela Comissão de Ética responsável e de acordo com a Declaração de Helsínquia revista em 2024 e da Associação Médica Mundial.

Proveniência e Revisão por Pares: Não comissionado; revisão externa por pares.

ETHICAL DISCLOSURES

Conflicts of Interest: During planning and conduct of the study, KR was a faculty member at the University of Houston (UH). On July 1, 2023, she became an employee of CooperVision and is currently an adjunct faculty at UH. None of her work on this paper was during her work at CooperVision and thus is only attributed to her affiliation at UH. CM developed the Orthokeratology and Contact Lens Quality of Life Questionnaire (OCL-QoL), and has a financial interest in this tool. Outside the submitted work, CM has received consultancy fees/honorarium/travel support (past 36 months) from: Acufocus (Irvine, California, USA), Atia Vision (Campbell, California, USA), Bausch and Lomb (Bridgewater, New Jersey, USA), Bayer (Leverkusen, Germany), British Society of Refractive Surgery (Oxford, UK), BVI (Liège, Belgium), Coopervision (Pleasanton, California, USA), Cutting Edge (Labége, France), Hoya (Frankfurt, Germany), Knowledge Gate Group (Copenhagen, Denmark), Johnson & Johnson Surgical Vision (Santa Ana, California, USA), Keio University (Tokyo, Japan), Medevise Consulting SAS (Strasbourg, France), Ophtec BV (Groningen, The Netherlands), Portuguese Society of Ophthalmology (Coimbra, Portugal), ROHTO (Tokyo, Japan), Royal College of Ophthalmologists (London, UK), SightGlass vision (Menlo Park, California, USA), Science in Vision (Bend, Oregan, USA), Scope (Crawley, UK), SpyGlass (Aliso Viejo, California, USA), Sun Yat-sen University (Guangzhou, China), Thea pharmaceuticals (Clemont-Ferrand, France), Vold Vision (Arkansas, USA). CM developed the Quality of Vision (QoV) questionnaire and has a financial interest in this tool. He also consults on topics including Rasch analysis, questionnaires, statistical analyses, and clinical/surgical ophthalmology topics. CM is a co-applicant on an awarded Welsh Government research grant related to diabetic eye disease (unpaid role), treasurer and council member of the British Society for Refractive Surgery (unpaid role) and a PROM advisor to the Royal College of Ophthalmologists (unpaid role). CM has undertaken paid peer reviews for Research Square (Durham, North Carolina, USA). CM is an editorial board member for Graefe's Archive for Clinical and Experimental Ophthalmology, Eye and Vision, Archives of Medical Science, Journal of Clinical Medicine, Journal of Ophthalmology, and Journal of Clinical and Experimental Ophthalmology. CM is an Associate Editor for Frontiers in Medicine – Ophthalmology. ML has done consulting for Euclid, Paragon Vision Science and Acuity Polymers.

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Confidentiality of Data: The authors declare that they have followed the protocols of their work center on the publication of patient data.

Protection of Human and Animal Subjects: The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and those of the Code of Ethics of the World Medical Association (Declaration of Helsinki as revised in 2024).

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REFERENCES

1. Dave T, Ruston D. Current trends in modern orthokeratology. Ophthalmic Physiol Opt. 1998;18:224-33.
2. The Vision Council. VisionWatch Vision Correction and Frame Reports. Alexandria: Vision Council; 2021.
3. Cope JR, Collier SA, Nethercut H, Jones JM, Yates K, Yoder JS. Risk Behaviors for Contact Lens-Related Eye Infections Among Adults and Adolescents - United States, 2016. MMWR Morb Mortal Wkly Rep. 2017;66:841-5. doi: 10.15585/mmwr.mm6632a2.
4. Stahl ED. Pediatric Refractive Surgery: A 2015 Perspective. Mo Med. 2015; 112:218–22.
5. Contact Lens Spectrum - Scleral Lenses for Healthy Eyes A World of Opportunities. Contact Lens Spectrum accessed Jan 2023 Available at: https://www.clspectrum.com/supplements/2016/october-2016/scleral-lenses-understanding-applications-and-max/scleral-lenses-for-healthy-eyes-a-world-of-opportu.
6. McGhee CN, Craig JP, Sachdev N, Weed KH, Brown AD. Functional, psychological, and satisfaction outcomes of laser in situ keratomileusis for high myopia. J Cataract Refract Surg. 2000;26:497-509. doi: 10.1016/s0886-3350(00)00312-6.
7. Lattery LJ, Chao C, Walline JJ, Bullimore MA, Ritchey ER, Skidmore K, et al. Patient and parent perceptions of myopia modalities. Cont Lens Anterior Eye. 2023;46:101772. doi:

10.1016/j.clae.2022.101772.
8. Lipson MJ, Sugar A, Musch DC. Overnight corneal reshaping versus soft disposable contact lenses: vision-related quality-of-life differences from a randomized clinical trial. Optom Vis Sci. 2005;82:886-91. doi: 10.1097/01.opx.0000180818.40127.dc.
9. Queirós A, Villa-Collar C, Gutiérrez AR, Jorge J, González-Méijome JM. Quality of life of myopic subjects with different methods of visual correction using the NEI RQL-42 questionnaire. Eye Contact Lens. 2012;38:116-21. doi: 10.1097/ICL.0b013e3182480e97.
10. Ritchey ER, Barr JT, Mitchell GL. The comparison of overnight lens modalities (COLM) study. Eye Contact Lens. 2005;31:70-5. doi: 10.1097/01.icl.0000146323.18919.13.
11. McAlinden C, Lipson M. Orthokeratology and Contact Lens Quality of Life Questionnaire (OCL-QoL). Eye Contact Lens. 2018;44:279-85. doi: 10.1097/ICL.0000000000000451.
12. Walline JJ, Gaume A, Jones LA, Rah MJ, Manny RE, Berntsen DA, et al. Benefits of contact lens wear for children and teens. Eye Contact Lens. 2007;33:317-21. doi: 10.1097/ICL.0b013e31804f80fb.
13. Rah MJ, Walline JJ, Jones-Jordan LA, Sinnott LT, Jackson JM, Manny RE, et al. Vision specific quality of life of pediatric contact lens wearers. Optom Vis Sci. 2010;87:560-6. doi: 10.1097/OPX.0b013e3181e6a1c8.
14. Pucker AD, Tichenor AA. A Review of Contact Lens Dropout. Clin Optom. 2020;12:85-94. doi: 10.2147/OPTO.S198637.
15. Basch E. Patient-Reported Outcomes - Harnessing Patients' Voices to Improve Clinical Care. N Engl J Med. 2017;376:105-8. doi: 10.1056/NEJMp1611252.
16. Rasch G. Probabilistic Models for Some Intelligence and Attainment Tests. New York: MESA Press; 1993.
17. Norquist JM, Fitzpatrick R, Dawson J, Jenkinson C. Comparing alternative Rasch-based methods vs raw scores in measuring change in health. Med Care. 2004;42:I25-36. doi: 10.1097/01.mlr.0000103530.13056.88.
18. Khadka J, McAlinden C, Pesudovs K. Quality assessment of ophthalmic questionnaires: review and recommendations. Optom Vis Sci. 2013;90:720-44. doi: 10.1097/OPX.0000000000000001.

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