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Objective and subjective evaluation of the performance of medical contact lenses fitted using a contact lens selection algorithm

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ABSTRACT

Purpose: To evaluate the performance of medical contact lenses (CLs) for a wide range of clinical indications.
Design: Prospective cross-sectional study.
Methods: A total of 281 eyes were evaluated in 281 consecutive patients (≥18 years of age; CL use ≥3 months) who visited the contact lens service in a tertiary academic clinic for a scheduled follow-up visit. The main outcome measured were clinical indications for CL wear; CL type; change in corrected distance visual acuity (CDVA) with CL use; CL wearing duration; CL wearing time; subjective performance measured using a visual analog scale (VAS) questionnaire (score range: 0–100); and effectiveness of the lens-selection algorithm.
Results: Wearing CLs significantly improved CDVA compared to wearing spectacles (median change: −0.15 logMAR, range: 1.00 to −2.10; $P<.001$). Daily-wear CLs were worn by 77% of patients for a median of 15 h/day (range: 5–18 h/day), median 7 days/week (range: 1–7 days/week). High subjective scores were measured, with similar results obtained between the scleral lens and soft lens groups. The medical CL fitting was found to be generally effective (the overall satisfaction rating was ≥70 for 81% of patients).
Conclusions: Fitting CLs based on the lens-selection algorithm yielded positive clinical results, including improved visual acuity, satisfactory wearing time, and high overall subjective performance. Moreover, subjective performance was similar between users of scleral lenses and users of soft lenses. These results underscore the importance of prescribing scleral lenses and the need for tertiary eye clinics to offer patients a variety of CL types.

To treat a wide range of ocular diseases, modern-day eye-care practitioners have a growing arsenal of medical contact lenses (CLs). The primary optical indication for fitting a patient with medical CLs is to improve visual acuity in cases of high refractive error and/or irregular astigmatism [1]; less common indications include anisometropia, nystagmus, and occlusion [2]. In a clinical setting, another important indication for CL use is for therapeutic purposes (e.g., in the case of a corneal bandage, in which the cornea is physically protected from the environment in order to improve hydration, promote corneal healing, and relieve pain) [3–10]. Often, several effects are desired [4,6]. All of these applications have specific requirements with respect to the lenses' design and material. A wide variety of CL types are currently available, including conventional soft lenses, silicone hydrogel lenses, rigid gas-permeable (RGP) corneal lenses, scleral lenses, hybrid lenses, occlusive lenses, iris print lenses, filter lenses, piggyback systems, and scleral prosthetics. Tailoring a CL to adequately fit the patient's needs requires a trained eye-care practitioner.

Clinical applications for CLs have expanded due to improvements in the materials used (for example, lens materials that are more oxygen-permeable) [3] and recent innovations in lens design, including custom-made specialized lenses [11,12], and toric- and tangential scleral lens designs [13–15]. In turn, these developments have altered the prescription habits of eye-care practitioners. For example, the improved material properties of silicone hydrogels has led to a major shift from conventional soft lenses to silicone hydrogel lenses [5,8]. More interestingly, the increased availability of custom-designed contact lenses for patients with keratoconus

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or keratoplasty [11,16–20] has been accompanied by a large increase in the use of scleral lenses [21–23].

Scleral lenses play an important role in medical CL practice, particularly in cases in which other lens designs have suboptimal results, for example in the case of unstable lens fitting, poor tolerance, unsatisfactory visual improvement, and/or unsatisfactory corneal bandage. However, the ability to fit scleral lenses requires specific skills and training. Another factor that has hampered the popularity of scleral lenses is prejudice with respect to poor handling of scleral lenses and a lack of comfort for the user. Recently, Van der Worp et al. [21] and Schornack [22] reviewed the outcomes of studies using scleral lenses, and several studies have evaluated the fitting of medical CLs in specific settings [1,3,5,7,19,24]. However, no overarching, evidence-based method for fitting the optimal CL type in more challenging clinical cases is currently available. In addition, the patients' subjective experiences based on these various treatment strategies also warrant attention.

Our goal was to evaluate the experiences of CL practitioners and patients in a large, tertiary clinic. Thus, we prospectively evaluated the outcomes of medical CL fitting in which the lens type is based on a practical lens selection algorithm, and we examined the clinical outcomes and patient satisfaction in response to the strategies chosen. Importantly, the comprehensive lens selection algorithm enables practitioners to achieve desirable results.

1. Methods

In this prospective observational study, we included all consecutive patients (in total 281 patients) who visited the Contact Lens service (Visser Contact Lens Practice) at the University Medical Center Utrecht from August 2014 through October 2014 for a follow-up for a medically indicated CL. The inclusion criteria were ≥18 years of age and CL use for ≥3 months prior to enrollment. The exclusion criteria were patients who came for an emergency visit or patients who were unable or unwilling to participate. Our institution's Ethics Review Board (Medisch Ethische Toetsingscommissie) ruled prospectively that approval was not required for this study; however, all participating patients provided written informed consent. All procedures were performed in accordance with the Declaration of Helsinki and with local laws regarding research on human subjects.

During the study visit, the primary and secondary clinical indication for CL use, CL type, and CL history were recorded; in addition, the following data were obtained from the patients' medical history: the presence of allergies and/or eczema, the use of topical eye drops (e.g., lubricants, prophylactic antibiotics, steroids, glaucoma eye drops, anti-allergy eye drops, or other eye drops), and average CL wearing time. Best corrected distance visual acuity (CDVA) was measured as Snellen visual acuity both with (CL CDVA) and without (spectacle CDVA) CLs.

All patients were also instructed to complete a questionnaire covering the following four specific topics: lens comfort, visual quality, lens handling, and overall satisfaction with their lenses. Scores were obtained on a visual analog scale (VAS); the scores ranged from 0 (unacceptable performance) to 100 (excellent performance). This questionnaire was used in our previous studies, and approval for using it here was granted by the Research and Ethics Committee of the City University, London, United Kingdom

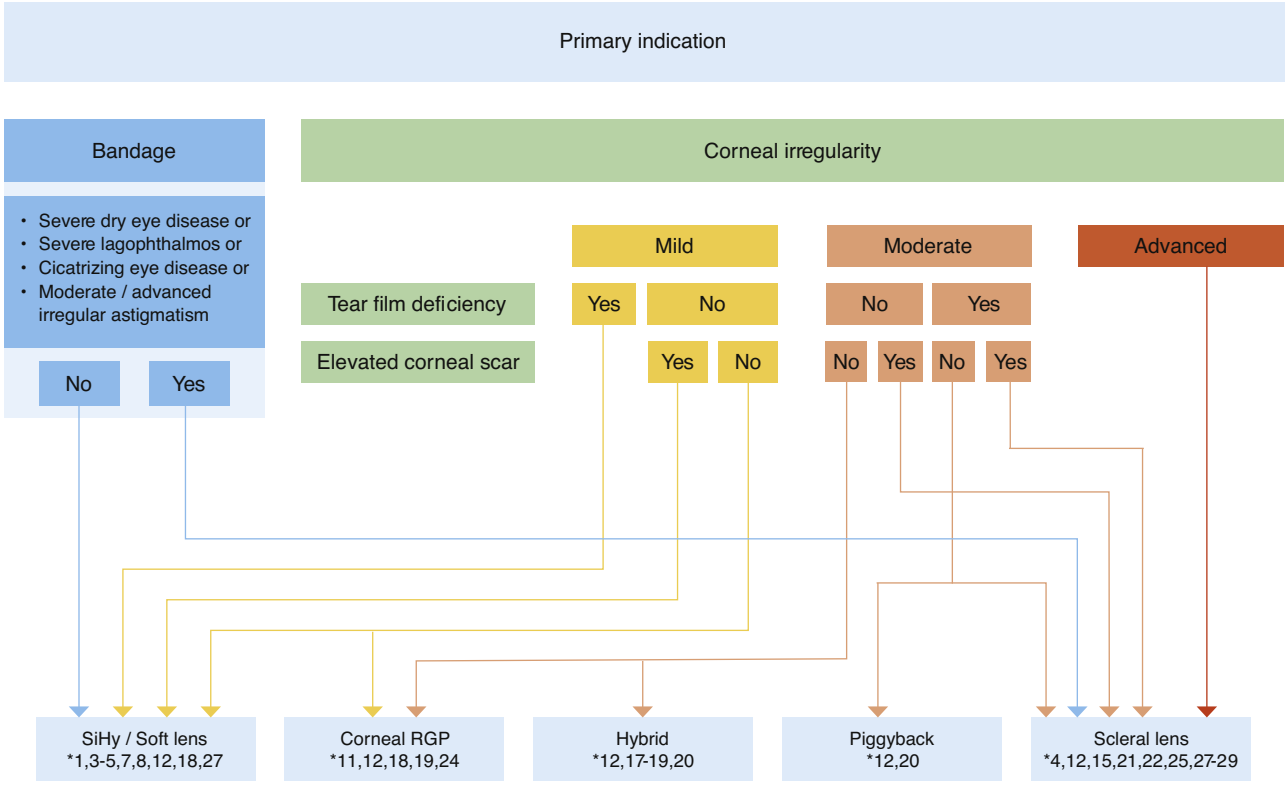

Fig. 1. Contact lens selection algorithm.
Description: A selection algorithm for selecting contact lenses for two principal medical uses: irregular astigmatism and bandage.
SiHy = silicone hydrogel; RGP = rigid gas-permeable.
* = references listed in the main reference list.
Mild corneal irregularity = acceptable subjective visual quality with SiHy; Moderate corneal irregularity = unacceptable subjective visual quality with SiHy, acceptable lens fit with RGP corneal; Advanced corneal irregularity = unacceptable subjective visual quality with SiHy, no acceptable lens fit with RGP corneal.
Note: The grading of severe dry eye included grade IV and V based on the Oxford Index for staining and tear film break-up time [30]. SiHy or RGP corneal trial lenses were used to determine the grade of "mild", "moderate", or "advanced" corneal irregularity.