

# Reducing dropout of contact lens wear with Biotrue multipurpose solution

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**Purpose:** To evaluate whether the use of Biotrue multipurpose solution (MPS) could significantly reduce the likelihood with which patients drop out of using daily wear contact lenses (CLs) amongst 18–44-year-old frequent replacement CL wearers.

**Methods:** Daily wear CL subjects habitually using MPSs (other than Biotrue MPS) who reported an intent to imminently drop out of CL wear because of comfort and dryness complaints were recruited to participate in this investigation. Subjects were switched to Biotrue MPS and continued to use habitual CL types with the new MPS for 2 weeks. Subjects completed an online satisfaction questionnaire at baseline and after 2 weeks to assess the change in symptoms and the intent to drop out of CL wear. Six months after completion of the initial study, a follow-up survey was administered to a subset of the initial participants.

**Results:** A total of 153 daily wear (silicone hydrogel and hydrogel) subjects completed this 2-week study with Biotrue MPS. When measuring those with the highest propensity to drop out of lens wear ( $n=93$ ) after switching to Biotrue MPS, 90% of subjects significantly reduced their likelihood of dropping out of CL wear ( $P<0.0001$ ). Online interviews were conducted with 73 of the study participants 6 months after completion of the initial study. A total of 93% of participants responded that they were still wearing CLs at least once per week. Of the 7% of respondents who were not currently wearing lenses 6 months after the initial study, two had dropped out of lens wear completely, and three still wore lenses less than once per week.

**Conclusion:** Patients intending to drop out of CL wear due to discomfort and dryness significantly reduced their propensity of discontinuing lens wear following use of Biotrue MPS. Six months after completion of the study, 93% of patients were still wearing CLs at least once per week.

**Keywords:** multipurpose solution, contact lens, dropout

## Introduction

Symptoms of dryness and discomfort are often cited as major factors related to the discontinuation of contact lens wear.<sup>1–8</sup> Dropout rates reported in the literature range from 15.9%–34%.<sup>1,5,8,9</sup> Despite the innovation of contact lens materials for daily wear/frequent replacement (ie, silicone hydrogels), the contact lens dropout rates have not changed over time.

Contact lens discontinuation has been identified as a contributing factor to stagnant lens growth.<sup>4,8</sup> However, it also has been reported that lapsed contact lens wearers can be successfully refitted with contact lenses,<sup>4,7,10</sup> and that the selection of contact lens material, design, replacement frequencies, and care systems can lead to continuation of contact lens wear.<sup>4,8,9</sup>

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The purpose of this study was to evaluate whether use of Biotrue multipurpose solution (MPS) (Bausch & Lomb Incorporated, Rochester, NY, USA) could significantly reduce a patient's likelihood of dropping out of the daily wear contact lens category amongst 18–44-year-old frequent replacement contact lens wearers.

## Methods

Participants were recruited by Kadence International (Boston, MA, USA), an online panel database of consumers who volunteered to take part in online surveys. Daily wear contact lens patients habitually using MPSs (other than Biotrue MPS) who reported their intent to imminently drop out of contact lens wear because of comfort and dryness complaints were recruited to participate in this investigation. To take part in the research, participants needed to meet the following criteria:

- Soft contact lens wearers who displayed a likelihood to drop out of the daily wear contact lens category;
- Close to dropping out of contact lens wear for self-reported comfort and/or dryness reasons;
- Between the ages of 18–44 years old;
- Been wearing lenses for at least 7 months;
- Must use multipurpose lens solution;
- Never used Biotrue MPS.

Following enrollment, subjects were provided with Biotrue MPS and asked to continue to use their habitual contact lens types with the new MPS for 2 weeks. Subjects were directed to follow the instructions on the package regarding proper use of the solution. Subjects completed an online satisfaction questionnaire at baseline and after 2 weeks of Biotrue MPS use. The questionnaire utilized a standard agree/disagree, 6-point Likert scale to assess patients' changes in symptoms and their intent to drop out of contact lens wear. A statistical analysis comparing pre- versus post-trial subject responses was performed using a nonparametric Wilcoxon's signed-rank test.

Six months after completion of the initial study, a follow-up survey was administered. The initial phase did not require that respondents participate in the 6-month follow-up; however, all participants in the initial phase were invited to participate. The follow-up was conducted to determine whether the participants had discontinued contact lens wear and if not, whether they continued the use of Biotrue MPS following the initial phase of the study.

The initial phase of this research was conducted from May 15, 2012 through July 22, 2012. The 6-month follow-up was conducted from January 1, 2013 through January 15, 2013.

## Results

### Initial study results

A total of 153 daily wear (silicone hydrogel and hydrogel) contact lens wearers completed this 2-week study with Biotrue MPS. Of the 153 lens wearers enrolled, only those with the highest propensity for discontinuation of lens wear ("slight chance", "probably", or "definitely will stop") were included in this report (n=93). Those who stated their likelihood to drop out as "might/might not stop" were not included in the analysis. The patient demographics for the full sample and the subset used for this report are listed in Table 1. The data on

**Table 1** Subject demographics

	Full study sample (n=153)	Subset of respondents (n=93)	Six-month follow-up (n=73)
Sex			
Male	35%	39%	29%
Female	65%	61%	71%
Age			
Mean age	32 years	32 years	32 years
35–44 years	32%	37%	29%
25–34 years	58%	55%	62%
18–24 years	10%	9%	10%
Household income			
\$125,000 or more	14%	18%	14%
\$100,000–\$124,999	18%	20%	19%
\$75,000–\$99,999	20%	18%	16%
\$50,000–\$74,999	23%	23%	23%
\$25,000–\$49,999	22%	18%	23%
Less than \$25,000	3%	2%	4%
Race/ethnicity			
White or Caucasian	75%	76%	74%
Asian or Asian American	9%	9%	12%
Black or African American	7%	5%	7%
Hispanic or Latino	6%	5%	4%
Other	3%	4%	3%
Level of education			
Advanced graduate work or PhD	9%	5%	13%
Masters degree	23%	26%	20%
Some graduate work	7%	8%	4%
Four-year college degree	34%	35%	35%
Two-year college degree	4%	5%	7%
Some college, but did not graduate	19%	21%	17%
High school graduate	3%	1%	4%
Region			
West	22%	24%	23%
Midwest	22%	18%	23%
Northeast	23%	23%	23%
South	34%	35%	30%

**Abbreviations:** n, number; PhD, doctor of philosophy.

habitual lens brands worn and lens care systems used are provided in Figures 1 and 2. Within the subset of patients, 39% of subjects reported using the Opti-Free family of solutions (Alcon Laboratories, Fort Worth, TX, USA) and 21% wore ACUVUE OASYS (Johnson & Johnson Vision Care, Jacksonville, FL, USA) silicone hydrogel lenses habitually.

Of the 93 subjects included in the analysis, 80% reduced their likelihood to discontinue contact lens wear after using Biotrue MPS for 2 weeks (post-study, they reported that they “probably” or “definitely will not stop”). The nonparametric Wilcoxon’s signed-rank test comparing pre- versus post-trial subject responses showed a statistically significant reduction in participants’ propensity to drop out of contact lens wear post-trial ( $P < 0.0001$ ). In order to be considered as reduced likelihood to drop out, subjects had to move at least one level on the six-point scale of propensity to drop out from pre-trial to post-trial (for example, from “slight chance I might stop” to “might/might not stop”) (Table 2). The percentage of subjects who lowered their propensity for discontinuing contact lens wear, as indicated by the number of levels lowered, are provided in Figure 3. Fifty-one percent (51%) of these subjects shifted to “definitely will not stop” wearing contact lenses after use of Biotrue MPS. Among the 84 subjects whose level of propensity changed after the study, 88% reduced their likelihood of discontinuing lens wear to “definitely not” or “probably not.” The reduced likelihood to discontinue lens wear was also significant for the 84 subjects whose level of propensity changed after the study ( $P < 0.0001$ ).

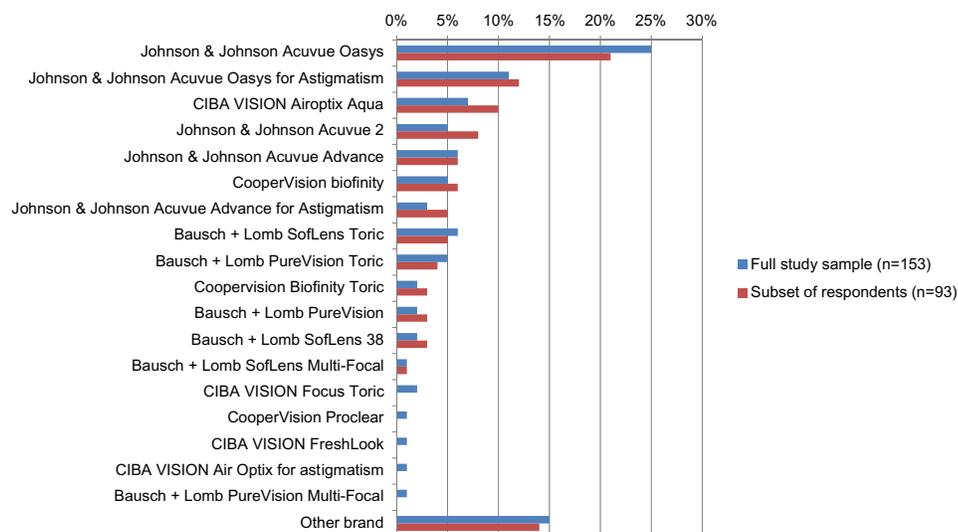
Of the nine respondents who reported that they “definitely will stop” before the trial, eight reduced their level to “definitely will not stop” after using Biotrue MPS for 2 weeks. Similarly, ten out of 18 of those who initially stated that they “probably will stop”, and 29 out of 66 who initially stated there was a “slight chance” they would discontinue lens wear, reported they “definitely would not stop” wearing lenses following the study. Every subject who initially claimed they would “probably” or “definitely” stop wearing contact lenses lowered their likelihood of discontinuing lens wear at the end of the study.

Many of the patients in the study had taken prior measures to curb the likelihood with which they would discontinue contact lens wear. For example, some measures that patients reported included wearing contact lenses less often, switching contact lens brands, using rewetting drops, switching contact lens solution brands, using a contact lens solution more often, and/or switching contact lens type (ie, using daily disposable lenses versus monthly lenses).

When asked to compare Biotrue MPS to their current lens care brand, 86% of all subjects reported that Biotrue MPS made their lenses more comfortable and 87% stated their lenses felt moister throughout the day. When asked how Biotrue MPS compared to what was expected when they agreed to take part in the study, 89% of all subjects found their experience using the care system to be better than expected.

## Six-month follow-up results

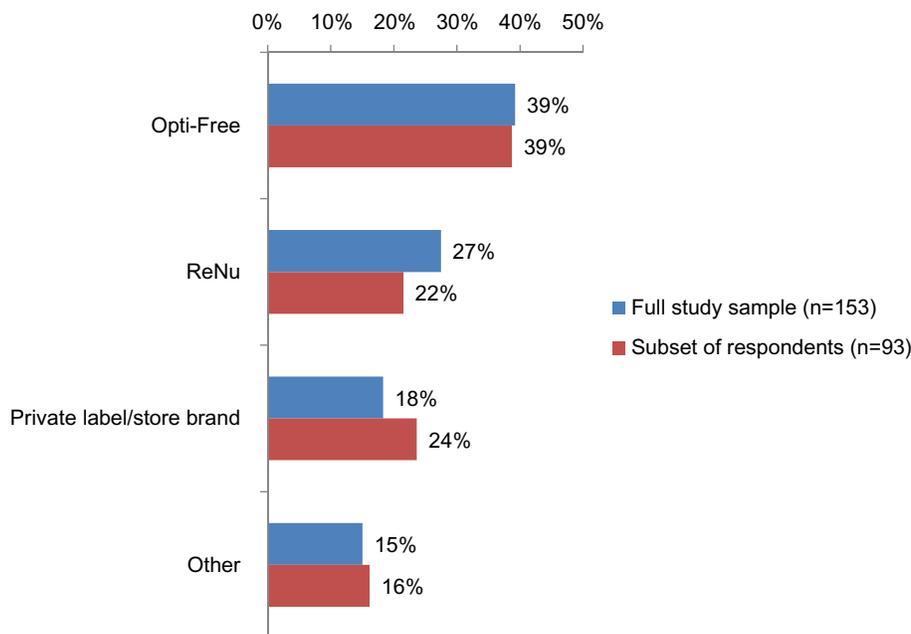
Online interviews were conducted with 73 of the study participants who responded to a follow-up survey 6 months after



**Figure 1** Breakdown of habitual lens brands worn by the subjects for both the full study sample and the subset of respondents.

**Notes:** Johnson & Johnson Vision Care, Jacksonville, FL, USA; CIBA VISION, Fort Worth, TX, USA; CooperVision, Pleasanton, CA, USA; Bausch & Lomb Incorporated, Rochester, NY, USA.

**Abbreviation:** n, number.



**Figure 2** Breakdown of habitual lens care use prior to enrollment in the study for both the full study sample and the subset of respondents.  
**Notes:** Opti-Free, Alcon Laboratories, Inc, Fort Worth, TX, USA; ReNu, Bausch & Lomb Incorporated, Rochester, NY, USA.  
**Abbreviation:** n, number.

completion of the initial study. A total of 93% responded that they were still wearing contact lenses at least once per week. Of the 7% of respondents who were not currently wearing lenses 6 months after the initial study, two had dropped out of lens wear completely and three still wore lenses less than once per week. When asked again about their likelihood to discontinue contact lens wear, 86% had reduced their

likelihood by at least one step in the continuum from pre-trial to 6 months post-trial.

After the initial 2-week trial, 81% of participants continued to use Biotrue MPS until the bottle was empty. Almost half of the original respondents (48%) were using Biotrue MPS at the time of the 6-month follow-up (Figure 4).

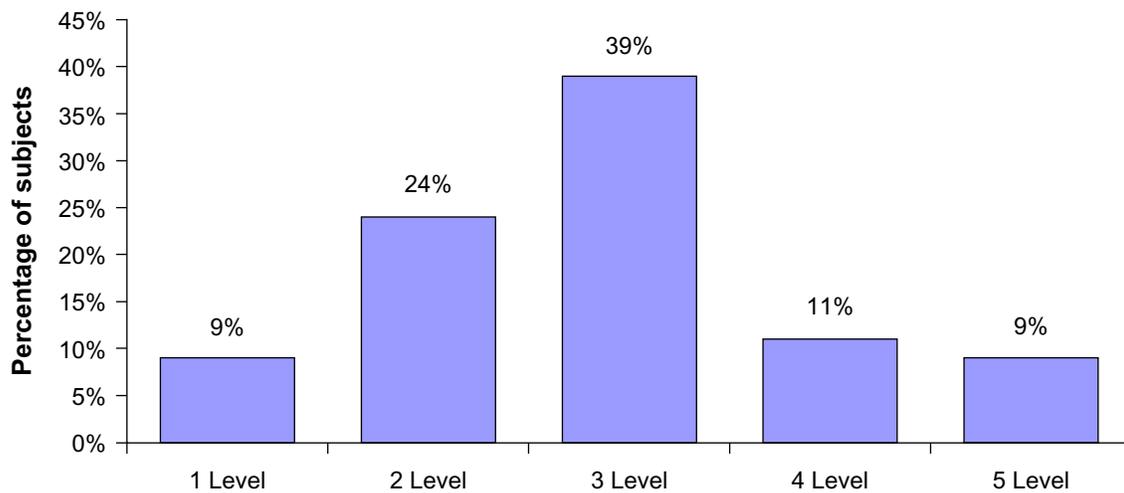
**Table 2** Change in the likelihood of dropping out of contact lens wear\*

	Likelihood of dropping out (among all subjects; n=93)		Likelihood of dropping out (among n=84 who lowered their drop-out propensity)	
	Pre-trial	Post-trial	Pre-trial	Post-trial
Definitely will not stop	Screened out	51%	Screened out	56%
Probably will not stop	Screened out	29%	Screened out	32%
Might/might not stop	Not included	10%	Not included	11%
Slight chance I will stop	71%	8%	68%	1%
Probably will stop	19%	2%	21%	0%
Definitely will stop	10%	1%	11%	0%

**Note:** \*Survey question: please use the scale below to indicate the likelihood of you stopping wearing contacts altogether in the next 6 months.  
**Abbreviation:** n, number.

## Discussion

In 1983, Berberian<sup>9</sup> reported a dropout rate of 30% among newly fitted contact lens wearers in the course of a year (20% for all new soft lens wearers and 40% for new gas-permeable lens wearers). Rumpakis<sup>1</sup> conducted a Web-based survey in 27 countries to identify the contact lens dropout rate, the reasons associated with the discontinuation of lens wear, and the resulting economic impact. The author found that the discontinuation rate varied by country and ranged from 15.9% in the United States to 31% in Asia/Pacific Rim, which were similar to those rates found by Berberian<sup>9</sup> 27 years earlier. Similar discontinuation rates were found by Pritchard et al<sup>8</sup> (who found that 34% had discontinued lens wear at least once in 1999) and Richdale et al<sup>5</sup> (who found that 24% of the sample had permanently discontinued contact lens wear in 2007). Contact lens discomfort is often cited as a major factor related to the discontinuation of contact lens wear.<sup>2-5,8</sup> In the Rumpakis<sup>1</sup> study, the top reasons for discontinuation were discomfort, poor vision, and expense,



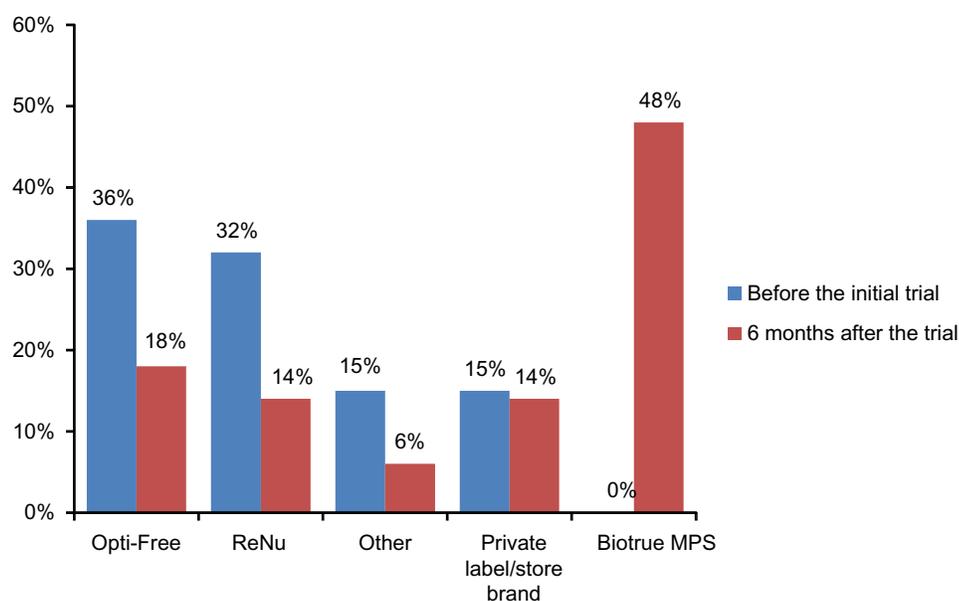
**Figure 3** Percentage of subjects who lowered their propensity for discontinuation of lens wear by the number of levels lowered.

although inconvenience and fear of eye infections were common complaints amongst Asian patients.

Other researchers have found similar reasons for participants' discontinuation of lens wear. Weed et al<sup>3</sup> surveyed 568 subjects in a study to determine the percentage of and reasons for discontinuation from contact lens wear. Of the 568 questionnaires that were returned, 51% of the subjects had discontinued contact lens wear. Twenty-seven (27%) percent of the 144 participants who had resumed lens wear discontinued a second time. The most common reason for discontinuation was discomfort/irritation. In 1999, Pritchard et al<sup>8</sup> reported on surveys received from 1,444 past or present

contact lens wearers. The primary reason reported for the discontinuation of lens wear was discomfort or irritation (49% of the 488 patients who had discontinued lens wear at least once). The authors also reported that "improved comfort and relief of dryness were the primary factors that would improve contact lens wear for the group that had discontinued".<sup>8</sup>

In a study of 236 lapsed contact lens wearers, Young et al<sup>4</sup> also reported discomfort as the primary reason for discontinuing lens wear in 51% of patients. The most common type of discomfort reported was dryness. More recently, Richdale et al<sup>5</sup> reported on the specific patient factors and



**Figure 4** Breakdown of lens care use for the patients included in the 6-month follow-up visit (n=73).

**Notes:** Opti-Free, Alcon Laboratories, Inc, Fort Worth, TX, USA; Renu and Biotrue, Bausch & Lomb Incorporated, Rochester, NY, USA.

**Abbreviation:** n, number.

characteristics related to contact lens discontinuation. They too found that ocular symptoms of dryness and discomfort were the most frequently reported reasons for discontinuation. Furthermore, Evans et al<sup>2</sup> also evaluated the factors related to discontinuation of silicone hydrogel contact lens wear. In their retrospective study, they found that patients who had discontinued lens wear reported a higher frequency of blurred vision, discomfort, lens awareness, burning and stinging, dryness, and redness.

With respect to symptoms of dryness and discomfort in the present study, 86% of all subjects reported that Biotrue MPS made their lenses more comfortable, and 87% stated that their lenses felt moister throughout the day. It is hypothesized that the reduction of these key symptoms played a role in the reduced propensity for contact lens wear discontinuation in our study. Biotrue MPS contains wetting agents, which can reduce the surface tension of a lens, helping moisture to spread easier across the lens.<sup>11,12</sup> The longer the wetting agents stay associated with the lens, the longer they may help to keep the lenses moist.<sup>13</sup> One such conditioning polymer found in Biotrue MPS is hyaluronan, a natural lubricant found throughout the human body, including in tears<sup>14</sup> and in the corneal epithelium.<sup>15</sup> Previous studies have shown the release of hyaluronan in both traditional hydrogel and silicone hydrogel contact lenses over a 20-hour time period.<sup>16</sup>

Although discomfort and dryness are often cited as the primary reasons for contact lens drop out, product-related reasons are also noted. In the previously mentioned study by Young et al<sup>4</sup> – who investigated 236 lapsed wearers who were refitted into contact lenses – the investigators concluded that some of the previous discontinuations were related to product performance. While the investigators agreed with the subjects' assessments of their own reasons for discontinuing contact lens wear, they also ranked up to three factors they believed were likely to contribute to the discontinuation of lens wear. The greatest difference between investigators' and patients' main reasons cited for contact lens discontinuation was related to care product performance. Although nonavailability of appropriate lenses was the main factor cited by investigators, they cited the care system as a factor in 10% of cases. In a study of multipurpose care systems, Stiegemeier et al<sup>17</sup> stated that "Selecting an appropriate lens care product enhances patients' wearing experience, maintains optimal lens performance and may help to prevent drop-out". Similarly, in his 2010 study, Rumpakis<sup>1</sup> concluded that "because the most frequently reported reason for dropout is discomfort, eye care practitioners should select contact

lenses and lens care products that increase comfort and provide good cleaning and disinfection".

The present study highlights the importance of selecting the appropriate lens care products. After using Biotrue MPS for 2 weeks, 90% of the soft contact lens wearers who were enrolled in the study reduced their likelihood of discontinuing contact lens wear by at least one level, with many showing reductions by several levels. Approximately half of the patients indicated that their likelihood of discontinuing lens wear had dropped to "definitely will not stop" wearing lenses following the study, and at the 6-month follow-up, 93% of patients were still wearing contact lenses at least once per week.

## Conclusion

When patients intending to drop out of contact lens wear due to discomfort and dryness were switched to Biotrue MPS, a significant reduction in the propensity for discontinuing lens wear was observed. Six months after completion of the study, 93% of patients were still wearing contact lenses at least once per week.

## Acknowledgments

This study was funded by Bausch & Lomb Incorporated.

## Disclosure

All authors were employees of Bausch & Lomb Incorporated at the time of writing this manuscript. The authors report no other conflicts of interest in this work.

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