

# History of Lens Care Products in Japan: Insights From Advertisements in the Journal of the Japan Contact Lens Society for 65 Years

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**Abstract:** This review examines the history of contact lens (CL) care products, particularly focusing on hard contact lenses (HCLs) like those made from polymethyl methacrylate and rigid gas permeable (RGP) materials. Although literature on CL history is extensive, there is limited information on the history of CL care products, especially in Japan. This review uses advertisements from the Journal of the Japan Contact Lens Society from 1959 to 2023 to trace the evolution of these products. The early HCL care primarily involved simple cleaning with dishwashing liquids because of the robust nature of polymethyl methacrylate lenses. Advertisements for care products became more prevalent with the introduction of RGP lenses that are more prone to dirt and deposit buildup. The first significant advertisements for HCL care products appeared in 1968, with notable products highlighting advancements in cleaning, rinsing, and storing solutions. The introduction of soft contact lenses in Japan in 1972 necessitated new care methods, such as boiling disinfection. Over the years, the market saw the introduction of various multipurpose solutions and specialized cleaning agents, although the number of advertisements for these products has declined since the late 1990s. Economic factors and changes in the CL industry have influenced the advertising trends observed in the journal. Despite the decline in market share for RGP lenses, they remain essential for specific conditions like keratoconus, some corneal disorders with irregular astigmatism, and moderate to high astigmatism. This review underscores the ongoing need for effective CL care products and the role of advertisements in documenting their history.

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## THE SCARCITY OF HISTORICAL LITERATURE ON CONTACT LENS CARE PRODUCTS

Literature on the history of contact lens (CL) is widely available worldwide.<sup>1–7</sup> On the other hand, relatively few articles are available on the history of CL care products, in particular that of care products for hard CLs (HCLs), such as those made of polymethyl methacrylate (PMMA) and rigid gas permeable (RGP) materials.<sup>8</sup> Since the advent of soft contact lenses (SCLs), CL care products have rapidly spread and evolved. In Japan, little has been published about the history of HCL care products. Only two articles were published, and there are in Japanese in the Journal of the Japan Contact Lens Society (JCLS), the Journal of JCLS.<sup>9,10</sup>

Most CL care products of the past are no longer sold, and records indicating when and for how long they were on sale are not available. In some cases, even the manufacturers themselves have no such records. Moreover, scientific papers on CL care products have rarely been published, both during the research phase and after their launch. These factors make it difficult to look back at the history of CL care products. In searching for an effective approach, we observed that each issue of the Journal of the JCLS includes advertising pages, similar to many other journals, and we hypothesized that reviewing all advertisements published in the Journal from its first issue in 1959 (volume 1) to the latest issue in 2023 (volume 65) should reveal changes in the types and quantities of CL care products. The cover of the current journal of the JCLS is shown in Figure 1. In this review, the survey covers 65 years using this novel approach to detail the history of CLs and CL care products in Japan as reflected by the advertisements. It also provides insights into the history of both the JCLS and its official journal, the Journal of JCLS.

## ANALYSIS OF CONTACT LENS CARE PRODUCT ADVERTISEMENTS IN THE JOURNAL OF JAPANESE CONTACT LENS SOCIETY

The Journal of the JCLS was published as an appendix to “Folia Ophthalmologica Japonica,” a Japanese Ophthalmological Journal, from 1959 until the end of 1979 and has been published as an autonomous journal since 1980, after which it has been

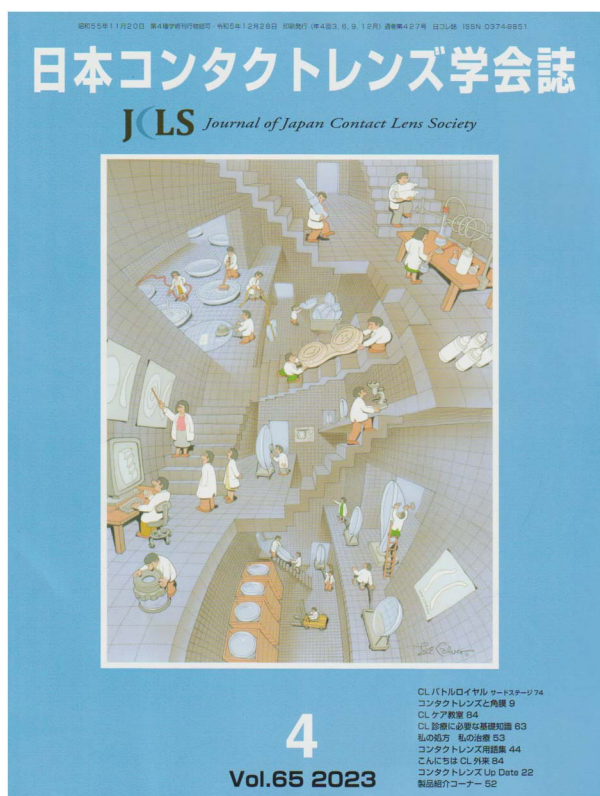


FIG. 1. The cover image of the Journal of the Japan Contact Lens Society. The image is from the last issue of the survey period.

issued as an independent academic journal. Since then, the journal has been published quarterly and continues to be so to the present day. To assess the advertisements throughout the journal's history, we examined all issues from the first one in 1959 to the last issue of volume 65 in 2023, counting the number of CL care products featured in advertisements in each issue. Then, we roughly classified the advertisements into two categories: those for HCLs and those for SCLs. Some of the CL care products that have appeared in the advertisement pages of the Journal of the JCLS are commercially available globally; however, others are available only in the market in Japan, so their trade names may not be widely known. Especially in the early years, the Journal contained many advertisements for CL care products that could be used for both HCLs and SCLs. In some advertisements, it was not specified whether the care product was for HCLs or SCLs, and in such cases, the advertisement was counted as "others." If the advertisement did not include a detailed description of the product's intended use, it was also classified as "others." Advertising pages are not included in the references, with some exceptions.

### Overview of Contact Lens Care Product Advertisements in the Journal of Japan Contact Lens Society

Figure 2 shows the number of care products, divided into HCL and SCL categories, featured in advertisements from the issue with the highest number of advertisements for each year, to avoid overly

detailed and complex data, although all issues were examined. Products that could be used for both HCL and SCL, or whose specific use was unclear, were categorized as others. The history of CLs and CL care in Japan, as reflected by the advertisements in the Journal of the JCLS, is described below.

### Early Days of Contact Lenses in Japan

The history of CLs in Japan began with the introduction of glass scleral lenses by Mikijiro Nishimura in 1916 and by Professor Shinobu Ishihara of Tokyo Imperial University in 1926.<sup>11–13</sup> From 1950, Mr Kyoichi Tanaka, Dr Yutaka Mizutani, and Professor Tsutomu Sato (Juntendo University) began prototyping PMMA contact lenses. In 1951, Mr Kyoichi Tanaka developed Japan's first domestically produced CL, which marked a shift from the previously dominant scleral lenses to corneal lenses.<sup>11–14</sup> In 1952, Dr Newton W. Wesley of the United States visited Japan and introduced the sphericon lens, a corneal lens made of PMMA. He agreed that a Japanese company could use the license to produce sphericon lenses, which led to the widespread use of CLs in Japan.

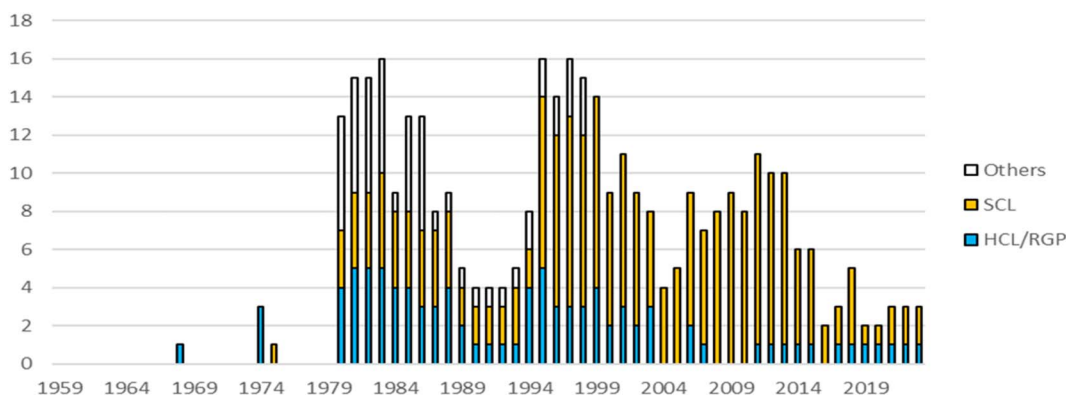
In 1958, "the All JCLS," the predecessor of the current JCLS, was inaugurated. The Journal of the All JCLS was first published in 1959; its successor, the Journal of the JCLS, celebrated its 65th anniversary this year.

Soft contact lenses were first introduced in Japan in 1972. They are made of hydroxyethyl methacrylate and, therefore, carry the risk of microbial adhesion and growth. Because SCLs had already been introduced in the United States and other countries, it was known that disinfection of SCLs was essential. Therefore, when the Japanese Ministry of Health and Welfare granted approval for marketing of SCLs in Japan, they mandated disinfection by boiling.<sup>15,16</sup> Since then, various methods have been used to disinfect SCLs, such as boiling disinfection and cold disinfection systems, including the currently most widely used cold disinfection system, multipurpose solution (MPS). In addition, countless products have been marketed.

Regarding HCLs, the development of sphericon lenses led to the current widespread use of CLs, but CL care products spread rapidly only after RGP materials, which accumulate dirt more easily than PMMA, started to be used for HCLs.<sup>9,10</sup> Although CL care products with disinfectant properties have recently been introduced for cleaning HCLs, the basic steps of HCL care, which have been in place for a long time, continue to be "washing, rinsing, and storing."

### Before 1968: Contact Lens Care in the Early Days of Hard Contact Lens Introduction in Japan

Although the basics of HCL care are washing, rinsing, and storing, as mentioned above, few records are available on CL care when HCLs were introduced in Japan because at that time, all HCLs were made of PMMA, a contaminant-resistant material. If CLs did become contaminated, they were cleaned with dishwashing liquid consisting mainly of a surfactant. Around the time that HCLs were introduced, the Journal of the JCLS did not contain any advertisements for CL care products, and advertisements promoting HCL care products emerged only after RGP HCLs, which are more prone to the accumulation of dirt and deposits, became widely used.



**FIG. 2.** Annual count of advertised care products for HCL and SCL in the Journal of the Japan Contact Lens Society. The number of care products is roughly divided into HCL and SCL care products. Each year, the issue of the Journal of the Japan Contact Lens Society with the greatest number of advertisements was analyzed. Items without specific HCL and SCL categorization, and those not specified, are shown separately as “others.” Below is an analysis of the reasons behind the decrease in the number of advertisements during the three distinct periods (arrows). (1) Around 1989: the so-called “bubble economy” began to collapse. As a result of the Bank of Japan raising interest rates, land and stock prices plummeted, leading to a long-term economic stagnation known as the “Lost Decade.” This economic downturn had a significant impact on the advertising market, with consumer spending being curbed and many companies reducing their advertising budgets during this period. (2) Around 2004: Japan had not yet fully recovered from the postbubble economic slump, and deflation persisted. During this time, domestic consumer demand remained weak, which likely suppressed corporate advertising activities. (3) Several factors influenced the Japanese economy around 2015, in addition to the damage caused by the 2008 global financial crisis (Lehman shock) and the 2011 Great East Japan Earthquake. The following three factors contributed to this: (1) the impact of abenomics: the economic policy known as “Abenomics,” initiated by Prime Minister Shinzo Abe, began around 2013 and was in its mid-stage by 2015. Although the policy focused on three “arrows”—monetary easing, fiscal stimulus, and structural reforms—the expected economic recovery lagged, and overcoming deflation proved difficult. (2) Consumption tax hike: In April 2014, the consumption tax was increased from 5% to 8%, which adversely affected consumer spending and slowed economic growth. This decrease in consumer expenditure led to a reduction in corporate sales and marketing activities, likely impacting the advertising industry as well. (3) Continued deflation: even after 2015, Japan had not fully escaped deflation. With stagnant prices, companies faced low profit margins, making them more cautious in their advertising spending. For companies to engage actively in advertising, strong consumer purchasing power and market growth are essential. HCL, hard contact lens; SCL, soft contact lens.

### 1968 to 1974: The First Advertisements for Hard Contact Lens Care Products Appear

In the May 1968 issue of the Journal (*J Jpn CL Soc* 10(5)), Welcon, a hydrophilic solution, was advertised as an imported product from the company Barnes-Hind in the United States with the tagline “wetting solution for CL wear.” The advertisement did not describe the ingredients and features of the product.

The July 1974 issue (*J Jpn CL Soc* 16(7)) carried advertisements for three different HCL cleaning products from Barnes-Hind: Welcon, Contacare (a solution for washing and storing HCLs), and Gelclean (a cleaning agent). These were the first CL care products in Japan to specifically mention the word “washing,” and their launch highlights the fact that HCL care products for washing, rinsing, and storing all became available at an early stage. In retrospect, the introduction of these three products was a turning point in the history of HCL care, so the following section provides a concise summary of the explanations for these three products.

Welcon is a “wetting solution” and “hydrophilic solution” containing polyvinyl alcohol, sodium chloride, hydroxyethyl cellulose, benzalkonium chloride, and sodium edetate. Its features include (1) making HCLs hydrophilic; (2) hygienic use because of aseptic preparation; (3) reducing foreign body sensation and

stabilizing lens application; (4) forming a protective film to prevent accumulation of dirt and deposits; and (5) providing lasting adherence to the lens surface. Contacare is a “cleaning and soaking solution” and “washing and storing solution” containing benzalkonium chloride and sodium edetate. Its features include (1) washing: used immediately after lens removal, with Gelclean recommended for stubborn dirt and deposits. (2) Storing: prevents adhesion of ocular secretions, maintains hydrophilicity, and prevents base curve changes. It also has bactericidal activity to inhibit bacterial growth during storage. Gelclean is a “cleaning gel” and “cleaning agent” containing a nonionic surfactant, propyl parahydroxybenzoate, and methyl parahydroxybenzoate. Its features include (1) high cleaning capability for effective removal of various substances. (2) Gel-like consistency prevents runoff during use and confusion with other solutions. (3) Thixotropic behavior allows it to spread well on lenses and be easily rinsed off with water (“Thixotropic” refers to a property of certain materials that are gel-like or solid when at rest, but become more fluid when agitated or stirred).

No other advertisement from the inception of the Journal to the present has included such a detailed description of the ingredients and usage of HCL care products, indicating that HCL care has become well established since the introduction of these products.

### 1971 to 1975: Emergence of Soft Contact Lenses and Cleaning Agents for Soft Contact Lenses

Soft contact lenses were approved by the Food and Drug Administration in 1971 and then by the Ministry of Health and Welfare in Japan in 1972.<sup>14,15</sup> As a condition of approval, boiling disinfection with saline was required.<sup>3</sup> The approved disinfection method was to scrub the CLs with a washing solution, rinse them with a storing solution (saline), and then place the SCL storage case in boiling water and boil it for 5 to 10 min or disinfect it with steam by using a steam sterilizer. However, although boiling can reliably kill microorganisms, it degrades SCLs and denatures the attached proteins by overheating, which causes SCL clouding and allergic reactions in the anterior eye. To overcome these shortcomings, in 1975, a tablet-type protein remover (enzymatic cleaner) was launched.<sup>15,16</sup> The July 1975 issue of the Journal (J Jpn CL Soc 17(7)) contained an advertisement for SofLens Cleaning Tablets, a cleaning agent for Bausch & Lomb's SCL SofLens, alongside an advertisement for SofLens itself. It was the first advertisement for an SCL care product and recommended weekly cleaning with the tablets.

### 1976 to 1980 and Beyond: The Journal of the Japan Contact Lens Society Becomes an Autonomous Publication

From 1976 to 1980, when the Journal of the JCLS was still an appendix to *Folia Ophthalmologica Japonica*, it did not contain any advertisements for CL care products for HCL or SCL. After it became an autonomous journal in 1980, the number of advertisements promoting CL care products for HCLs, SCLs, and both HCLs and SCLs increased to 4, 6, and 3, respectively.

### The 1980s and 1990s: Pinnacle of Contact Lens Care Product Advertisements

From the 1970s onward, advertisements emphasized the importance of disinfection, particularly in the context of SCL care. In the 1980s, in which RGP material took over from PMMA as the primary material for HCLs, accumulation of dirt and deposits of HCLs was identified as a problem, and more kinds of HCL care products were released.

Regarding SCLs, weekly disposable SCLs and frequent replacement SCLs were first marketed in Japan in 1991 and 1994, respectively. In 1991, SCL cold disinfection care products with 3% hydrogen peroxide went on sale.<sup>15,16</sup> In the same year, the Japan Contact Lens Association, a CL-related industry organization, defined voluntary safety standards to ensure the safety of care products for both HCLs and SCLs and to press for improvement in their quality. An MPS that accommodated all aspects of SCL washing, rinsing, disinfection, and storage was released in 1995. In 1996, as a result of relaxed regulations in Japan, cold disinfectants for SCL were classified as quasi-drugs rather than drugs. In 1996, a MPS with polyquaternium was released, but it was never advertised in the journal.<sup>15,16</sup>

Against this backdrop, from 1980 onward, there was a sustained increase in the number of advertisements for new CL care products, both for HCLs and SCLs, but the number of brands peaked in 1995 and 1997, respectively. In 1995, a daily disposable SCL was released for the first time in Japan.

### After 1997: Phasing Out of Advertisements for Contact Lens Care Products

After 1997, the number of advertisements for CL care products gradually declined. In 1999, an MPS containing polyhexamethylene biguanide was first introduced as an SCL care product, and in 2001, a disinfectant containing povidone-iodine was launched, also for SCLs. In 2015, a MPS containing polyquaternium and alexidine was released, but its product was never advertised in the journal, neither in the advertisement pages nor as a reference.<sup>16</sup> In 2021, a MPS containing polyhexamethylene biguanide and alexidine hydrochloride was launched that had higher disinfection efficacy. Before that time, corneal infections caused by *Acanthamoeba* and fungi among SCL users were increasing and becoming a significant issue in Japan.<sup>17</sup>

Although the Journal has continuously run advertisements for CL care products for SCL through its most recent issue in 2023, only a single brand has been advertised in each year since 2019. Advertisements for HCL care products were found in the Journal each year from 1980 to 2003, but not from 2004 to 2010. From 2011 (when a povidone-iodine disinfectant for HCL was introduced) to 2023, the period covered by our research, HCL care products were advertised each year except 2016. The release of new CL care products is likely because of the ongoing occurrence of severe cases of CL-related ocular complications, particularly infections caused by *Pseudomonas aeruginosa*, fungi, and *Acanthamoeba* sp.<sup>18</sup>

## DISCUSSION

### Historical Significance of Analysis of Contact Lens Care Product Advertisements

In this review, we counted the number of advertisements for CL care products in the Journal of the JCLS because we thought that examining solid records (albeit only advertising pages) in an academic journal would provide more reliable information than performing a survey to ask people about their memories of products. As noted in the Introduction, two articles on HCL care products were previously published in Japanese, the second at the request of the editorial board of the Journal of the JCLS. To our knowledge, the present article is probably the first to describe the history of both HCL and SCL care products in Japan in an international journal. We believe that it is meaningful to present the obscure history of CL care products in Japan to globally, by introducing in an English language publication.

As far as the history of CLs is concerned, there is a wealth of literature on CL materials, design, products, formulation theories, fitting conditions, complications, and so on.<sup>1-7</sup> There are also many reports on CL care products, including ingredients, effects, and complications.<sup>10-12</sup> However, the history of CL care products has rarely been described, especially in Japan. The fact that not all products are necessarily mentioned in the literature made it difficult for us to review their history in Japan. Therefore, we decided to review the advertisement pages in the Journal of the JCLS from its first issue to the most recent one (the final issue of volume 65 in 2023) and thereby to focus on the types and numbers of CL care products in the advertisements. Unfortunately, some excellent CL care products were not listed in those advertisements, which may have introduced bias to the study.

The number of advertisements placed in journals is also influenced by the global economic climate. In the current century, the number of CL users in Japan is said to have exceeded 15 million, accounting for more than 10% of the total population.<sup>19</sup> Considering the large number of CL users, there have been relatively few advertisements for CL care products, especially in this century. In Japan in particular, this apparent disconnect may be attributable to the economic downturn precipitated by the Lehman Brothers bankruptcy and the aftermath of the Great East Japan Earthquake. The decline of RGP lens market share does not seem to be a problem limited to Japan.<sup>20–26</sup> Efron<sup>27</sup> expresses his concern in a paper with the shocking title Obituary—rigid contact lenses. However, RGP lenses are still needed for patients with keratoconus and corneal ectasia, some corneal disorders with corneal irregular astigmatism, and for orthokeratology. As long as there is this need, ophthalmologists have a mission to take care of the eyes and visual function of patients who require them.

### An Unexpected Benefit: Filling Missing Issues in the National Diet Library Collection

Although we sought to review every issue of the Journal of the JCLS, some issues were difficult to come by, and in such cases, the National Diet Library's collection was helpful. Since the coronavirus pandemic, older books in the National Diet Library's collection have become largely accessible via the Internet. Prospective users can access the Library's collection for free once they visit the Library and are registered as a user. However, users cannot access recent issues without directly visiting the Library, a restriction that aims to avoid a decline in the circulation of journals.

Although reviewing the advertising pages of the Journal of the JCLS, we found that 4 years' worth of issues were not available in the collections of any of the authors. We searched for these issues in the collection of the National Diet Library, but some were missing there, which could have made our research incomplete. We contacted the editorial team of the Journal of the JCLS and encouraged them to donate the missing issues to the National Diet Library, which they kindly did, meaning that all issues of the Journal of the JCLS are now available at the National Diet Library. The availability of all issues should be useful for future researchers interested in the history of CLs in Japan.

### CONCLUSION

Since the introduction of CL technology in Japan in the 1950s, many CL care products have been imported. Unsurprisingly, during that time research in the country mostly lagged behind that in Europe and the United States. However, Japanese firms later started manufacturing CLs and CL care products for the domestic market. In Japan, both CLs and care products are increasingly produced domestically, reflecting a unique evolution that can be likened to Galápagosization specific to the Japanese market. For example, iodine-based solutions have been developed for both SCLs and RGP lenses. By reviewing all the advertising pages in the Journal of the JCLS, we found that the introduction of some products with new concepts represented turning points in the care of CLs, and we also gained the impression that manufacturers expected to and were passionate about creating novel, improved products that can reduce the likelihood of CL-associated ocular complications. We assume that in the future, companies in Japan

will continue to develop CLs and CL care products to overcome any unanticipated problems that may arise.

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