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John T. de Carle (1926–2022)

John Trevor de Carle was born on the 20 May 1926 in Mitcham, Surrey. He was the only child of Doris W de Carle (née Newson) (1899–1980) and Cecil E. de Carle (1895–1998). On leaving school, he studied ophthalmic optics (i.e. optometry) at Northampton Polytechnic in London, the title of which has become City, University of London. In May 1945 he passed the examinations for the professional qualification of the Worshipful Company of Spectacle Makers (FSMC) and then completed compulsory military service, classified as an 'optician', in Royal Air Force hospitals. About 1963 he gained the Diploma in Contact Lens Practice (DCLP) of the British Optical Association and he became a Fellow of the American Academy of Optometry in September 1970.

In 1949, John married Helene R. Kulp (1924–2007) and they had one child, Clive. Following his divorce, John married Barbara H.M. Curran (1937–1993) in 1963 and then Marnie E. Francis (1935–2019) in 1997.

Throughout his career, de Carle was an innovator in the field of contact lenses and for many of his inventions he was granted a patent. In 1951, when very few optometrists fitted contact lenses and corneal lenses were still a novelty, he applied for a patent, describing their production by a process of "moulding a paste comprising a mixture of methyl methacrylate monomer and polymer" [1].

Two years later, he designed a novel variation on the Tuohy lens in which the back peripheral zone was 'built up' and the fenestrated back optic zone was claimed to provide an apical tear layer thickness of 80 μm, a value considered that had been considered to be optimal for the optic zone of scleral lenses [2,3].

Over a period of many years, de Carle submitted several applications for patents relating to bifocal and multifocal contact lenses. In November 1957, de Carle filed his first application for a US patent for a simultaneous vision bifocal corneal lens design [4]. The concentric design had a steep back surface central distance portion, 2–4 mm in diameter, surrounded by a near portion. This patent came to the attention of a major American contact lens manufacturing laboratory, Plastic Contact Lens Company in Chicago (later better known as Wesley Jessen Inc.) since at that time it had been developing a front surface concentric bifocal which also had a central distance portion. As the consequence of subsequent collaboration, de Carle agreed to establish Sphercon Contact Lens Co Ltd at 65 Grosvenor Street, London as a subsidiary of Plastic Contact Lens Company and in 1960 this address appeared as that of his practice in the first edition of the Opticians Register. This company was bought out in 1963 and became Contactalens Ltd based in Baker Street, London [5].

In recognition of his expertise, de Carle became the author of the chapter on bifocal and multifocal corneal lenses in the classic British textbook, *Contact Lenses* [6]. He retained responsibility for this chapter in the second, third and fourth editions of this work.

Prior to the constraints of the Medicines (Specified Articles and Substances) Order of 1976 which regulated contact lens solutions, de Carle was able to use his kitchen as a 'laboratory' in which to devise and produce contact lens solutions, an endeavour which lead to the formation of the Contactasol Ltd in Esher, Surrey to market them [5].

In 1970, when most hyrogel materials available had a water content of 40% with a few in the region of 60%,de Carle decided to produce one with a water content of about 70%, approximating that of the cornea, in the belief that it would be suitable for extended wear. His kitchen was once again used as a place in which to conduct experiments. On one occasion, a sealed bottle of 'plastics' exploded in the oven and the consequent obnoxious smell caused several of his neighbours to be concerned that there had been a gas leak! [7]. These experiments culminated with an application in 1973 by Global Vision, Inc. for a United States patent for a hydrophilic terpolymer with de Carle identified as its inventor [8]. This material, Perfilcon-A, had a water content of 74% and was used initially by Global Vision (UK) ltd to manufacture the Permalens which had a monocurve back surface and, unlike other hydrogel lenses, was fitted steeper than the cornea in the case of myopic patients. Its total diameter ranged from 12.00 to 13.50 mm (0.50 mm intervals) and the back optic zone radius ranged from 6.50 to 8.00 mm (0.30 mm intervals) [9]. By 1972, de Carle was fitting 90% of his new patients with the Permalens [10].

According to de Carle the fragility of the Permalens represented an advantage since it compelled patients to obtain replacements before problems arose and he considered that these lenses could be worn safely day and night for periods of three months [11]. In 1983, he confirmed that throughout the preceding 10 years his 'average extended wear patient' had achieved this mode of wear [7].

de Carle was a member of, and served as an officer of, the International Society of Contact Lens Specialists and of the Association of Contact Lens Practitioners. Representing the latter, he was involved in the negotiations with the Contact Lens Society, the Association of

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Dispensing Opticians Study Group and the Medical Contact Lens Association which resulted in the formation in January 1977 of the British Contact Lens Association (BCLA) [12]. de Carle became the first President of the BCLA and, in his Address given in this capacity, he presented the results of a survey of 200 consecutive patients who sought fitting with extended wear lenses [11].

In 2002 de Carle's practice, which had been located since about 1970 at 73 New Bond Street in the exclusive and affluent Mayfair district of London, was sold and in 2006, he was awarded honorary life membership of the BCLA.

The final patent application submitted by de Carle, at the age of 83, appears to have been in March 2010 for a multifocal design, for a contact lens or intraocular lens, comprised of 'a plurality of annular concentric refractive zones' [13].

Of his various enterprises and inventions, de Carle will undoubtedly be remembered principally for his work with the Permalens and in 1987 a biographer wrote that 'he has achieved world renown as the "father of extended wear"' [14].

John de Carle John died peacefully in his sleep on 27 June 2022 and is survived by his son and by three grandchildren.

Acknowledgement

The portrait appears with permission of the British Optical Association Museum, College of Optometrists, London, UK. Accession number LDBOA2022.492.2.2.

References

[1] de Carle JT, inventor. Improvements in or relating to contact lenses. United Kingdom patent GB731155. 1955 Jun 1.
[2] de Carle J. Corneal flange contact lenses. A preliminary report. Optician 1953;126 (3248):616–7. 620.
[3] de Carle, JT, inventor. Corneal contact lenses. United Kingdom patent GB802486. 1958 Oct 8.
[4] de Carle JT, inventor. Bifocal corneal contact lens, United States patent US3037425. 1962 Jun 5.
[5] Bowden TJ. Contact lenses: the story. Gravesend: Bower House; 2009.
[6] de Carle JT. Bifocal and multifocal corneal lenses. In: Stone J, Phillips AJ, editors. Contact Lenses: a textbook for practitioner and student. London: Butterworths; 1972. p. 363–94.
[7] de Carle J. Extended wear lenses – past, present and future. J Br Contact Lens Assoc 1983;6(4):134–6.
[8] de Carle JT, inventor; Global Vision, Inc., assignee. Hydrophilic gel terpolymers from hydrophilic n-vinyl monomers, hydroxyalkyl acrylates or methacrylates and polymerizable unsaturated carboxylic acids. United States patent US3937680. 1971 Feb 10.
[9] Gasson AP. Soft lens fitting. In: Stone J, Phillips AJ, editors. Contact lenses: a textbook for practitioner and student. 2nd ed. vol 2. London: Butterworths; 1981, p. 400–67.
[10] de Carle J. Developing hydrophilic lenses for continuous wearing. Aust J Optom 1978;55(9):343–6. https://doi.org/10.1111/j.1444-0938.1972.tb06279.x.
[11] de Carle J. Survey of 200 consecutive patients requesting Permalenses in April/May 1976. J Br Contact Lens Assoc 1978;1(1):3–7.
[12] Gasson A, Bowden T. The first 30 years. London: British Contact Lens Association; 2007.
[13] de Carle JT, inventor. Multifocal lens. International patent WO2011107723. 2011. Sep 9.
[14] Rakow PL. John de Carle: profile of a pioneer. J Ophthalmic Nurs Technol 1987;6 (1):34–5.

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