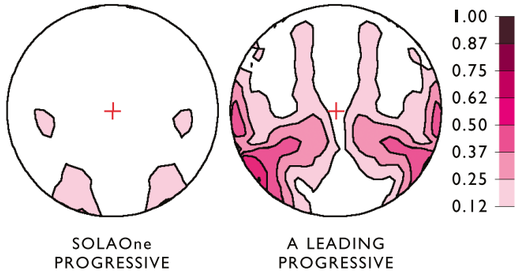

Figure 7. *SOLAOne has virtually no binocular power difference, compared to a leading progressive lens*

As a result of these refinements, the distance, intermediate, and near viewing zones of both the right and left lenses have near-perfect alignment during binocular vision, ensuring the largest areas of clear binocular vision at all distances. Few progressive lenses come close to this level of binocularity.

Consistent Performance

A versatile lens design would be of limited value if only certain wearers benefited from its balanced optics. SOLAOne incorporates one of the most advanced Design by Prescription™ strategies available to ensure that *all* wearers – myopes, hyperopes, and emmetropes – get consistently excellent all-around performance at *all* stages of their presbyopia. Each base curve and add power combination has been individually optimized to ensure that the designs deliver the same versatility and balanced performance for each wearer:

- The size of the near zone increases slightly with base curve. This ensures that hyperopes, whose fields of view are normally reduced because of magnification, receive the same generous near field size as myopes in *object* space.
- The asphericity of the distance zone has been optimized for each base curve, allowing for thinner, flatter lens profiles, larger fields of view, and equally low levels of peripheral blur.
- The shape and inset of the progressive corridor has been corrected for each individual base curve and add power to ensure that the centers of the viewing zones are properly aligned with the lines of sight during intermediate and near vision.
- The SOLAOne design also varies by add power to deliver consistently excellent performance through all stages of presbyopia.

Conclusion

In addition to the multi-task analysis described earlier, the versatility of SOLAOne was further borne out by extensive wearer trials conducted by the Queensland University of Technology School of Optometry and independent optometrists. The wearer satisfaction levels that appear in Figure 8 from one trial (with 227 respondents) substantiate the design choices made for SOLAOne quite dramatically. Clearly, wearers found that SOLAOne had equally exceptional performance across the full range of viewing conditions, indicating that the lens offers true versatility.

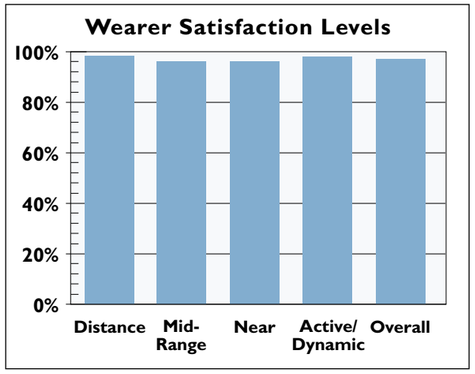

Figure 8. *Wearers showed virtually equal satisfaction with distance, intermediate, near, and dynamic vision*

For the wearer, this versatility takes the form of the greatest degree of capability in the greatest number of real-world visual tasks. For the practitioner, it means the ability to deliver a high level of visual performance regardless of the patient's prescription, add power, or frame style choice.

It is this consideration of both the visual demands of the wearer and the dispensing challenges of the eye care practitioner that makes SOLAOne "the first progressive lens designed for real life."

*Thirteen optical measurements were assessed across a range of over 2,500 randomly selected laboratory Rx jobs, resulting in over 450,000 individual computations. Results were based upon percentage of time wearers typically spent on each task and the optical measures relevant to it, and were scaled from lowest to highest on a five-score scale.

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SOLA One™ PROGRESSIVE LENSES

white paper

The progressive lens designed for real life.

Darryl Meister, ABOM, Technical Marketing

Executive Summary

A progressive lens can truly claim to be "general-purpose" only if it offers genuine versatility by performing equally well in all of the wearer's common visual activities. Moreover, it must achieve this performance consistently for all wearers. Through extensive vision research and visual ergonomic analysis, SOLA lens designers have gained an unparalleled understanding of the typical presbyope's visual task requirements, and have translated that understanding into the most versatile and advanced progressive lens design available: SOLAOne™. SOLAOne promises to meet the daily visual demands of all of your wearers by delivering consistently excellent performance and versatility.

The Problem

The market is full of progressive lenses that aim to be "general-purpose." Do these progressives truly satisfy the needs of today's presbyopes? Wearer trial and theoretical analysis data reveal that current progressive lenses generally do not perform well across the full range of common visual tasks. The key limitation of these designs is that, while claiming to be "general-purpose," they actually place an emphasis on some aspect of performance and, as a result, don't perform equally well in diverse situations.

For a design to be truly general-purpose, it must offer genuine versatility, working equally well for all of the primary visual activities engaged in by the wearer – and it must achieve this consistently for *all* wearers.

Introducing SOLAOne

SOLAOne meets the criteria of versatility by delivering superior optical performance across the range of visual tasks that wearers perform every day. The SOLAOne design is the result of a ten-year vision research program, which included three large-scale, university-conducted development wearer trials and two broad, market-based trials, in addition to a visual ergonomic analysis of over 10,000 presbyopic subjects using proprietary head-tracking technology.

SOLA's vision research program created a new understanding of wearers' visual task requirements and the lens design elements and geometry needed to fulfill them. This ultimately led to the development of a progressive that performs demonstrably better in the visual tasks that wearers encounter every day.

Using advanced ray-tracing software and statistical processing, the optical performance of SOLAOne and 13 leading progressive lens designs was analyzed for the fifteen most common visual tasks, as defined by SOLA's vision research. The results were conclusive: SOLAOne achieved the highest overall score, as well as the highest score in 12 out of the 15 categories. Results for SOLAOne and two leading designs are shown in Figure 1. Of these fourteen progressive lenses, SOLAOne consistently stood out as the one choice for versatility.*

Multi-Task Analysis

BEST ● ◐ ○ ◑ ◯ ORDINARY

Visual Task Category	SOLAOne™	Lens A	Lens B
Reading a Newspaper	●	◐	◐
Reading a Book	◐	○	○
Computer	●	◐	◐
TV/Movies	○	●	●
Driving	●	●	●
Craft/Hobbies	●	◐	○
Housework	●	◐	◐
Sewing/Needlework	●	○	○
Office Work	●	○	○
Gardening	●	●	●
Sports/Golf	●	●	●
Cooking	●	◐	○
Walking	◐	●	●
Writing/Drawing	●	◐	○
Shopping	●	●	◐
Versatility Score	●	◐	◐

Figure 1. *Multi-task analysis comparison*

Designed for Versatility

SOLAOne's unparalleled versatility is the result of a unique design strategy that maximizes visual task performance using these key design strategies (Figure 2):

1. A unique balance among the central viewing zones in accordance with wearer priorities for near, intermediate, and distance vision tasks
2. A balance between the ultra-soft periphery and broad central viewing zones in accordance with wearer priorities for sustained and dynamic vision
3. An emphasis on binocular vision, so that this exceptional optical performance is maintained while both eyes work together as a system
4. Advanced Design by Prescription™ technology, so that the lens performs equally well for all wearers, regardless

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of their distance prescription, add power, or previous multi-focal history

5. An 18mm minimum fitting height that allows the wearer a wide range of frame style choices without compromising optical performance

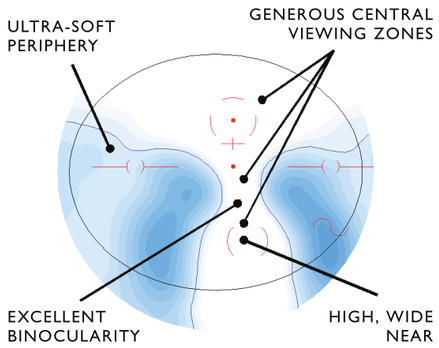

Figure 2. *SOLAOne employs several key features*

Balance of Central Viewing Zones

Sustained central viewing tasks require generous zones of clear vision that afford good visual acuity. While many progressive lens designs offer more than adequate distance vision, few offer a true balance between distance, intermediate, and near vision. SOLAOne employs a uniquely optimized balance (patent pending) among viewing zones to deliver *equally* exceptional vision at distance, intermediate, and near.

The lens design has been further optimized for the typical *as-worn position*, which accounts for the influence that oblique aberrations, reading distance, lens tilt, and vertex distance have on the final optical powers of the lens. This affords larger zones of clear vision, allowing SOLAOne to deliver superior optical performance in real-life situations.

SOLA's vision research has shown that near-vision tasks are highly variable. For instance, lens performance depends upon the position of the near object (or reading material) and the posture of the wearer. Thus, reading a newspaper at the breakfast table is a significantly different task from reading a book in bed. True versatility requires that the lens offer excellent performance in a variety of near tasks.

The SOLAOne design employs a large near zone that widens higher than those of conventional progressive lenses (Figure 3). This, combined with SOLAOne's as-worn optimization, accommodates a wide variety of reading tasks, as well as other up-close tasks like writing and needlework.

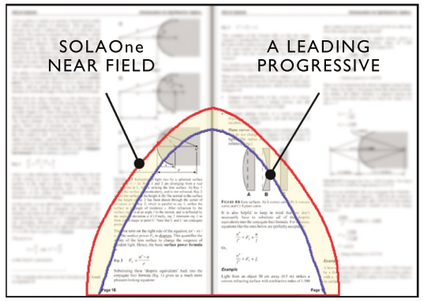

Figure 3. *SOLAOne delivers a larger field of near vision than most leading progressives*

SOLAOne's high, wide near zone has an additional benefit: it allows excellent near vision at fitting heights as low as 18mm, extending SOLAOne's versatility to frame selection as well (Figure 4).

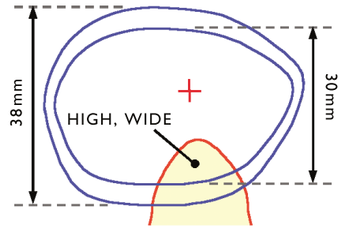

Figure 4. *SOLAOne delivers outstanding near performance, even in small frames*

Intermediate vision is often neglected in general-purpose progressive lenses, in spite of the fact that computer use, an intermediate-dominant task, is increasingly important to wearers. In order to maintain truly balanced vision, SOLAOne was designed with a generous intermediate zone, as the comparison in Figure 5 confirms.

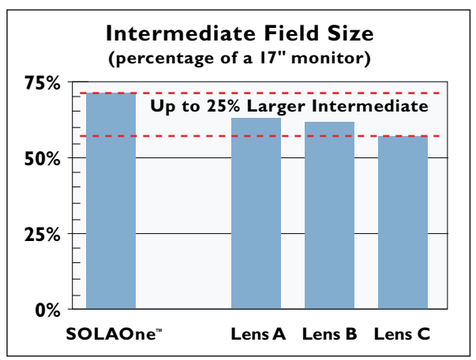

Figure 5. *SOLAOne provides an exceptionally large field of view for intermediate vision*

Central and Peripheral Vision

True versatility requires an effective balance between *central* and *peripheral* vision performance, since wearers will use their progressive lenses for both sustained and dynamic (or active) viewing tasks. Distance-dominant tasks, in particular, tend to involve a combination of both sustained central vision and dynamic peripheral vision (e.g., driving, walking, playing or watching sports), while relatively few involve sustained straight-ahead vision only (e.g., watching television).

While visual acuity remains important during dynamic vision, the optical effects influencing the identification and spatial localization (apparent location) of objects in the periphery, as well as the wearer's sense of balance and stability, are paramount. Many current progressive designs employ unnecessarily large distance viewing zones, which needlessly compromise the peripheral optics by increasing the rate of change in unwanted astigmatism between the central distance zone and the periphery. SOLAOne, by contrast, has a balance between the central distance zone and the periphery that is more in line with wearer preference.

Proprietary wearer preference trials organized by SOLA's vision scientists confirm that progressive wearers prefer a softer distance vision boundary in the periphery, with more gradual changes in unwanted surface astigmatism. Based on this research, SOLAOne has been engineered with extremely low levels of unwanted astigmatism and one of the softest peripheral designs on the market, as shown in Figure 6. This ultra-soft design affords excellent dynamic vision, great wearer comfort, and fast adaptation.

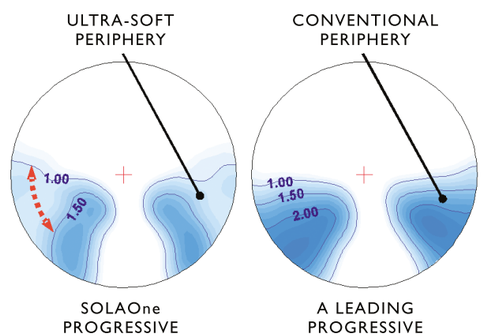

Figure 6. *The widely-spaced astigmatism contours of SOLAOne indicate a softer periphery (+2.00 adds)*

Additional wearer preference trials were conducted to investigate the optimum peripheral design for reducing image swim in progressive lenses. Image swim occurs when the changing prism induced by the unwanted astigmatism of a progressive lens causes objects to appear to shift, distort, or even sway unnaturally. This "rocking" phenomenon results in a sensation of *vertigo* – or motion sickness – for the wearer in extreme cases. SOLAOne's peripheral optics were specifically optimized to induce minimal image swim compared to many leading progressive lenses. This benefits tasks like Driving, Sports/Golf, Walking, Shopping, well as visually dynamic tasks, like Cooking and Office Work.

SOLAOne also delivers exceptional dynamic and peripheral *mid-range* vision, as a result of its soft distance-periphery boundary and smooth transitions around the corridor. This approach to intermediate design contributes to high scores in tasks such as Cooking, Gardening, Shopping, and Office Work.

Maximized Binocularity

Because most vision tasks involve both eyes working together in unison, versatility depends on the binocular optimization of the lens design. This requires *maximizing* the *binocular alignment* of the central viewing zones of the right and left lenses in order to provide the largest possible regions of good binocular acuity, and to allow the wearer to engage in sustained viewing tasks longer without fatigue. It also requires *minimizing* the *binocular power* and *prism differences* between the right and left lenses, so that the wearer can perform dynamic tasks and transition between tasks with less "swim" and visual disturbance.

SOLAOne was designed using a state-of-the-art system of binocular analysis and optimization. The design process involves the simultaneous optical analysis of the right *and* left eye-lens systems using computer *ray-tracing*. Using this advanced system of lens design, the binocular differences in power, prism, and magnification between the right and left lenses have been virtually eliminated. The contour plots in Figure 7 compare the optical power differences between the right and left lenses for both SOLAOne and a leading progressive.

While binocular *power differences* were *minimized* between the right and left lenses, binocular *alignment* was *maximized*. Proprietary head-tracking technology was used to assess the ergonomic behavior of over 10,000 presbyopes during key visual tasks. These ergonomic data were vital to fine-tuning the geometry of the progressive corridor and viewing zones for factors such as the wearer's accommodative demand and typical working distances.