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OmniLux®

NAL® Natural Accommodation Lens

Whitepaper

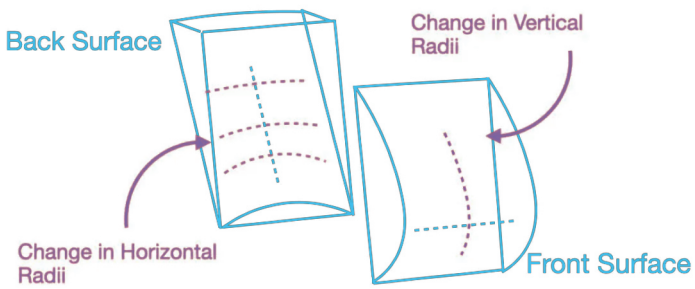
A NEW CONCEPT OF MULTIFOCAL LENS

Since the first commercially viable progressive lens was introduced in the late 1950s, advancements in technology and software engineering have allowed for development of visually advanced designs. Despite these advancements, there are still compromises and challenges to progressive addition lenses for the patients:

- Cumbersome navigation through narrow intermediate and near portion of the lens.
- Spatial disorientation, nausea, or dizziness due to peripheral waviness and distortions.
- Potentially frustrating adaptation period.

But before we introduce a new concept to address these challenges, let's take a brief walk through the history of multifocal lenses.

History of Progressive Addition Lenses (PAL)



The first patent for a progressive lens was British Patent 15,735, granted to Owen Aves with a 1907 priority date. Unlike modern progressive lenses, it consisted of a conical back surface and a cylindrical front with opposing axes to create a power progression.

The first commercially viable progressive lens in Europe, Essel's Varilux, was introduced in 1959. In 1965 the Univis Omnifocal was introduced in the United States. The first progressive lenses were made of glass. In 1972 Essel changed its name to ESSILOR because of the fusion of two companies, Essel and Silor. In 1976 the first organic progressive lens, Essilor's version of Columbia Resin 39 (CR39) index 1.50, the Varilux Orma, was released. Physicist Werner Koeppen and his team worked on the development of the Varilux Comfort from 1960 into the 1990s, and VARILUX became the most successful PAL. Over half a century has passed since the introduction of the PAL, and the world has not been the same.

The PAL Evolution and Its Current State

The advancements in equipment, technology, and software mathematical and development tools have opened the doors to amazing new conceptual and design possibilities - the Freeform Revolution! First, it was OptoTech's founder Roland Mandler, who, in 1985, adapted aerospace industry computer numerical control (CNC) technology in the production of ophthalmic lenses. Then, in 1986, Gunter Schneider of Schneider GmbH started using CNC technology in precision optics production, which later evolved into ophthalmic lens production. However, the biggest game-changer in PAL evolution came with the development of PAL Freeform Lens Design Software.

On October 11, 1977, Japanese scientists Hiroyuki Mukalyama and Kazutoshi Kato filed a patent application for a progressive multifocal lens and manufacturing method. The US 6,019,470 patent was granted on February 1, 2000 and was assigned to Seiko Epson Corporation. On July 18, 2000, the USPTO granted a patent for a spectacle lens with a spherical front side and multifocal back side and process for its production, US6089713A, to Albrecht Hof and Aldabert Hanssen. They then assigned it to Carl Zeiss Vision GmbH.

Both patents followed the conventional PAL concept, but instead of utilizing a semifinished lens with the progressive design cast or molded on the front side of the lens, the multifocal surface was created on the back of a rotationally symmetrical front of a semifinished donor lens blank. In addition to the PAL design on the back side of the lens, the final lens back surface was further modified with Individual Optimization.

Over the past twenty-plus years, that concept and production technology radically improved the visual performance and acceptance/adaptability of multifocal lenses. Today, apart from ZEISS and SEIKO, there are numerous freeform lens design companies like IOT, Crossbows, Shamir, Horizon and HOYA, to name a few.

THE DREAM CONCEPT IS BORN

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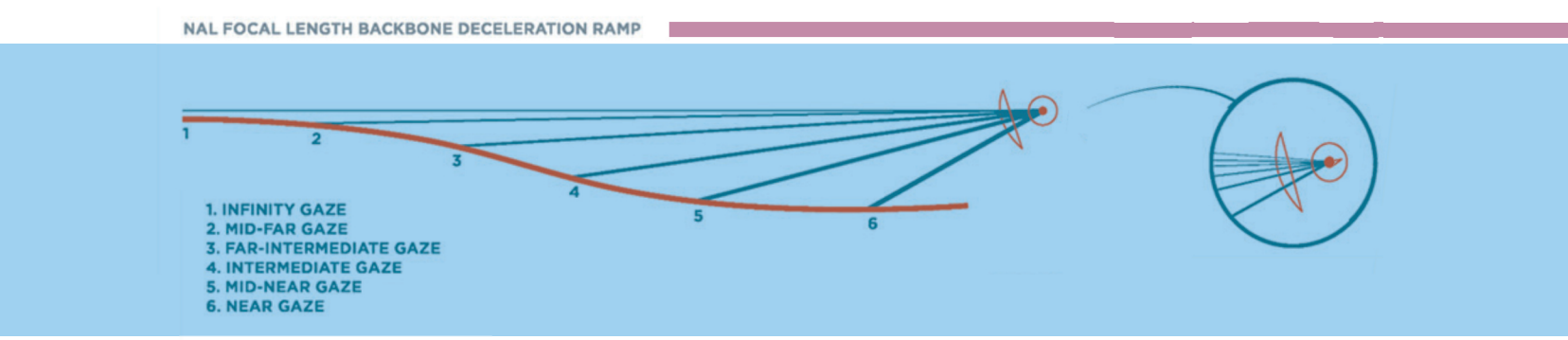
All freeform lens designs currently in the market are based on the conventional PAL utility, providing distance, intermediate, and near vision with about a +/- 8mm progressive corridor. Hundreds of PAL designs and individual optimization nuances offer "unique" or "proprietary" features. Although even the most astute ECPs aren't able to study and assess differences, most freeform lens manufacturers tend to offer three types of PAL designs: GOOD, BETTER, or BEST.

Addressing the Challenge of PAL Lenses

It is more than 60 years since the introduction of Progressive Addition Lenses. Despite all these advancements since introduction, current designs still provide challenges to the patient that we set out to address. In order to do so, we must drop our self-imposed limitations, think outside the box, and start our quest armed with new knowledge, unaffected insight, creativity and commitment. Our dream wish list of enhancements include the following:

- NO ADAPTATION PERIOD or NON-ADAPTS due to feelings of swim or nausea.
- NO ADAPTATION PERIOD or NON-ADAPTS due to the learning process of navigation through a vision corridor.
- NO FITTING HEIGHT MEASUREMENTS that are often complex and time-consuming should not be required.
- NO IRRITATING AND COSTLY REDOS due to inaccurate fitting height measurements.



An Entirely New Concept of Multifocal Lenses

Upon extensive deliberations and complex considerations, a multifocal lens that would almost certainly meet the wish list criteria could be developed. After nearly 5 years of development, a functional, commercially viable, cloud-based freeform digital lens design platform was developed.

To gain new, untainted optical insight, we studied large numbers of fitting height statistical data based on frame measurements, frame shapes, and pantoscopic angles. We created unconventional eye-lens ergonomic models and studied natural vision dynamics, and natural vision habits, consulted with numerous ECPs, optical business experts, and professionals, and the NAL® Natural Accommodation Lens concept was born.

The NAL® does not have the short, awkward to navigate intermediate vision corridor inherent in PALs. NAL® has a funnel- shaped visual field comprised of substantially aspheric, lateral power bands that are aligned along a vertical design backbone. The design backbone has mathematically created curvature based on actual natural downward gaze focal length deceleration requirements based on our unique eye/lens interaction ergonomic model, and extensive PAL fitting data.

The focal length deceleration curve addresses natural accommodation requirements for focal lens reduction from 6 meters (20') all the way to 25 cm (1') along a continuous, smooth focal length deceleration ramp

The Brain behind NAL®

Michael Walach, the inventor of the NAL® design, is the President of Quest Vision Care Specialty Lab and the CEO of QLDS, both located in Largo, Florida.

THE BENEFITS OF
NATURAL ACCOMMODATION LENS

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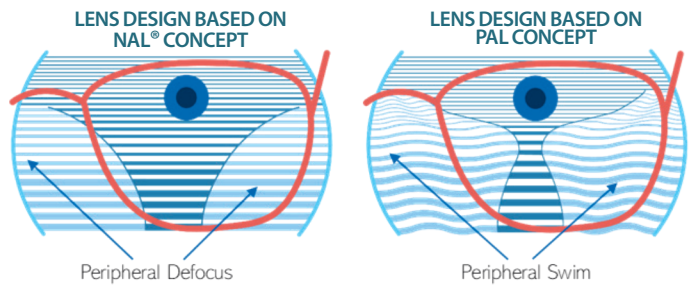
The objective of the NAL concept is to provide a youthful, natural single-vision viewing experience for active and professional presbyopes. Our numerous wearer studies proved that the actual viewing experience with the NAL is more natural and closer to the visual experience afforded single vision lens wearers. Remember youthful vision? Remember how natural the transition from the office, golf, bike, tennis, or viewing the computer screen? This is the visual experience that patients desire in their multifocal eye-wear.

The NAL Concept and Features

The NAL visual field is shaped like a funnel or martini glass. Therefore, it does not have a short, narrow intermediate vision corridor like a PAL. The NAL has no progressive corridor. Consequently, NO time-consuming FITTING HEIGHT measurement is required, which means that NO issues arise from incorrect FITTING HEIGHT. And there are NO irritating redo's typically caused by PALs ordered with an incorrect fitting height.



To change the focal distance in NAL, the patient gently lowers or raises their chin to fix their gaze on the object viewed and perfectly focus on the distance needed.

No Adaptation Period or Non-Adapts

The NAL design eliminates the peripheral swim effect inherent in PAL due to peripheral defocus. We have been able to achieve that effect by:

• The application of substantially lateral aspheric broad power bands aligned vertically along the NAL backbone and interpolated by various bi-quadratic, cubic, and quintic polynomials and splines into one smooth continuous surface.

• Complex digital ironing out across visual field peripheral areas.

• Significant reduction in focal length deceleration rate along the substantially vertical NAL principal design axis due to a 2 to 4 times longer add power acceleration ramp radically reduces unwanted lateral astigmatism as per Minkwitz Theorem.

• NO ADAPTATION PERIOD or NON-ADAPTS due to the learning process of navigation through a short and narrow intermediate vision corridor. Because the NAL visual field is funnel-shaped, NAL adaptation is virtually instant, and the navigation is intuitive and natural.

In Summary

Since SEIKO, ZEISS and RODENSTOCK pioneered the backside lens surface individual optimization concept over 20 years ago, more than 200 "proprietary" or patented designs have been introduced. New PAL innovation at this time appears to be trying to squeeze water from the stone with the same concept, just a different brand.

The NAL Natural Accommodation Lens design truly revolutionizes the multifocal lens design industry by offering a new concept. It enables both eye care professionals and patients alike to access a lens that is the closest to a single vision lens and provides a viewing experience that's as close to natural vision as it gets.

Sources:

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https://www.liquisearch.com/progressive_lens/history
https://progressive-glasses.com/the-history-evolution-of-progressive-lenses

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