TRANSLATING PRESBYOPIC CONTACT LENS PAIR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a translating contact lens pair comprising optical power zone features that are different in each lens of the pair, and more particularly to a translating contact lens pair comprising optical power zone features which are different in segment height, power, asphericity, shape, orientation and/or inset of the first lens intended for the first eye as compared to segment height, power, asphericity shape, orientation, or inset of the second lens intended for the second eye.

2. Discussion of the Related Art

In a newborn, the crystalline lens of the eye is somewhat soft and pliant making it extremely flexible and capable of a large degree of accommodation or focusing. As a person ages, the crystalline lens gradually becomes more rigid, and thus, their eyes are less able to accommodate, or bend the natural lens, to focus on objects that are relatively near to the observer. This condition is known as presbyopia.

A plus power lens may be utilized to restore the focusing power lost by the crystalline lens. The plus power lens may take the form of reading glasses, bifocal glasses or trifocal glasses. Reading glasses are easily utilized when an individual does not need refractive correction for distance. However, distant objects will be blurry when looking through reading glasses. If an individual is already wearing glasses for myopia, hyperopia and/or astigmatism, then the plus power may be added to the existing glasses in the form of a bifocal or trifocal lens. Contact lenses may also be worn to address presbyopia. In one type of such lenses, distance and near vision regions are concentrically arranged around the geometric center of the lens. Light passing though the optical zone of the lens is concentrated and focused at more than one point in

112, with the highest order polynomial in the equation describing the surface of any subzone being between about two (2) to about twelve (12).

In another preferred exemplary embodiment, the optical power zone 108 of the first contact lens 102 comprises a distance vision subzone 110 and a near vision subzone 112, and the optical power zone 108 of the second contact lens 104 comprises a distance vision subzone 110 and a near vision subzone 112, with the highest order polynomial in the equation describing the surface of any subzone being between about three (3) to about six (6).

In another preferred exemplary embodiment, the optical power zone 108 of the first contact lens 102 comprises a distance vision subzone 110 and a near vision subzone 112, and the optical power zone 108 of the second contact lens 104 comprises a distance vision subzone 110 and a near vision subzone 112, with the equation describing the surface of any subzone being between one described by a bicubic, spline, Chebyshev or trigonometric function.

In another preferred exemplary embodiment, the segment inset 120 or horizontal distance from the vertical meridian 103 to the near or intermediate vision segment optical center 122 for the first contact lens 102 is different than the segment inset 120 or horizontal distance from the vertical meridian 103 to the near or intermediate vision segment optical center 122 of the second contact lens 104. In a preferred exemplary embodiment, the segment inst 120 for the first contact lens 102 is between about 0 to about 2 mm and the segment inset 120 of the second contact lens 104 is between about 0.4 to about 2.5 mm. In another preferred exemplary embodiment, the segment inset 120 for the first contact lens 102 is between about 0.5 to about 1.5 mm and the segment inset 120 of the second contact lens 104 is between about 1 to about 2 mm.

For convenience, the boundaries of the various zones illustrated in Figure 1 are shown as discrete lines; however, one of ordinary skill in the relevant art will recognize that the boundaries may be blended by any suitable

CLAIMS

1. A translating contact lens pair for treating presbyopia comprising:

a first contact lens including an optical zone, a peripheral zone and an edge zone and having a first set of optical zone features with a first set of values for the features; and

a second contact lens including an optical zone, a peripheral zone and an edge zone and having a second set of optical zone features with a second set of values for the features, wherein a value of at least one feature in the first set of optical power zone features is different than the value of that feature in the second set of optical power zone features and wherein the optical zone of each contact lens is asymmetric about the vertical meridian of the contact lens wherein the first set of optical zone features comprises a first predetermined power of the lens and the second set of optical zone features comprises a second predetermined power of the lens and wherein the first predetermined power is 100 percent power and the second predetermined power is less than 100 percent power.

2. The translating contact lens pair according to claim 1, wherein the optical zone of each contact lens comprises at least one distance vision subzone above a horizontal meridian of the contact lens.

3. The translating contact lens pair according to claim 1, wherein the optical zone of each contact lens comprises at least one near vision subzone below a horizontal meridian of the contact lens.

4. The translating contact lens pair according to claim 1, wherein the optical zone of each contact lens comprises at least one intermediate vision subzone.

5. The translating contact lens pair according to claim 1, wherein the peripheral zone of each contact lens includes a pseudotruncation design feature on an anterior surface thereof.

6. The translating contact lens pair according to claim 2, wherein the first set of optical zone features comprises a first predetermined segment height (or vertical distance from the lens center to the closest vertical point of the near or intermediate vision subzone) and the second set of optical zone features comprises a second predetermined segment height.

7. The translating contact lens pair according to claim 6, wherein the first predetermined segment height ranges from 0 to 1.0 mm and the second predetermined segment height ranges from 0.4 to 2.0 mm.

8. The translating contact lens pair according to claim 6, wherein the first predetermined segment height ranges from 0 to 0.6 mm and the second predetermined segment height ranges from 0.6 to 1.5 mm.

9. The translating contact lens pair according to claim 1, wherein the first predetermined power is 100 percent power and the second predetermined power ranges from 25 to 75 percent power.

10. The translating contact lens pair according to claim 1, wherein the first predetermined power is 100 percent power and the second predetermined power is 50 percent power.

11. The translating contact lens pair according to claim 1, wherein the first predetermined power is less than 100 percent power and the second predetermined power is less than 100 percent power, but not equal to the first predetermined power.

12. The translating contact lens pair according to claim 1, wherein the first set of optical zone features comprises a first predetermined asphericity and the second set of optical zone features comprises a second predetermined asphericity.

13. The translating contact lens pair according to claim 12, wherein the first and second predetermined asphericities have conic constants between +0.5 and –1.0.

14. The translating contact lens pair according to claim 1, wherein the first set of optical zone features comprises a first predetermined shape and the second set of optical zone features comprises a second predetermined shape.

15. The translating contact lens pair according to claim 14, wherein the first and second predetermined shapes are identical.

16. The translating contact lens pair according to claim 14, wherein the first and second predetermined shapes are not identical.

17. The translating contact lens pair according to claim 1, wherein the first set of optical zone features comprises a first predetermined orientation relative to the vertical meridian and the second set of optical zone features comprises a second predetermined orientation relative to the vertical meridian.

18. The translating contact lens pair according to claim 17, wherein the first and second predetermined orientations are identical.

19. The translating contact lens pair according to claim 17, wherein the first and second predetermined orientations are not identical.

20. The translating contact lens pair according to claim 1, wherein the first set of optical zone features comprises a first predetermined inset (or the nasalward horizontal displacement of the geometric center of the near or intermediate vision subzone relative to the lens center) and the second set of optical zone features comprises a second predetermined inset (or the nasalward horizontal displacement of the geometric center of the near or intermediate vision subzone relative to the lens center).

21. The translating contact lens pair according to claim 20, wherein the first predetermined inset ranges from 0 to 2.0 mm and the second predetermined inset ranges from 0.4 to 1.5 mm.

22. The translating contact lens pair according to claim 20, wherein the first predetermined inset ranges from 0.5 to 1.5 mm and the second predetermined inset ranges from 1.0 to 2.0 mm.

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The present invention relates to a translating contact lens pair comprising optical power zone features that are different in each lens of the pair, and more particularly to a translating contact lens pair comprising optical power zone features which are different in segment height, power, asphericity, shape, orientation and/or inset of the first lens intended for the first eye as compared to segment height, power, asphericity, shape, orientation, or inset of the second lens intended for the second eye.

2. Discussion of the Related Art

In a newborn, the crystalline lens of the eye is somewhat soft and pliant making it extremely flexible and capable of a large degree of accommodation or focusing. As a person ages, the crystalline lens gradually becomes more rigid, and thus, their eyes are less able to accommodate, or bend the natural lens, to focus on objects that are relatively near to the observer. This condition is known as presbyopia.

A plus power lens may be utilized to restore the focusing power lost by the crystalline lens. The plus power lens may take the form of reading glasses, bifocal glasses or trifocal glasses. Reading glasses are easily utilized when an individual does not need refractive correction for distance. However, distant objects will be blurry when looking through reading glasses.

If an individual is already wearing glasses for myopia, hyperopia and/or astigmatism, then the plus power may be added to the existing glasses in the form of a bifocal or trifocal lens. Contact lenses may also be worn to address presbyopia. In one type of such lenses, distance and near vision regions are concentrically arranged around the geometric center of the lens.

Light passing though the optical zone of the lens is concentrated and focused at more than one point in

112, with the highest order polynomial in the equation describing the surface of any subzone being between about two (2) to about twelve (12).

In another preferred exemplary embodiment, the optical power zone 108 of the first contact lens 102 comprises a distance vision subzone 110 and a near vision subzone 112, and the optical power zone 108 of the second contact lens 104 comprises a distance vision subzone 110 and a near vision subzone 112, with the highest order polynomial in the equation describing the surface of any subzone being between about three (3) to about six (6).

In another preferred exemplary embodiment, the optical power zone 108 of the first contact lens 102 comprises a distance vision subzone 110 and a near vision subzone 112, and the optical power zone 108 of the second contact lens 104 comprises a distance vision subzone 110 and a near vision subzone 112, with the equation describing the surface of any subzone being between one described by a bicubic, spline, Chebyshev or trigonometric function.

In another preferred exemplary embodiment, the segment inset 120 or horizontal distance from the vertical meridian 103 to the near or intermediate vision segment optical center 122 for the first contact lens 102 is different than the segment inset 120 or horizontal distance from the vertical meridian 103 to the near or intermediate vision segment optical center 122 of the second contact lens 104.

In a preferred exemplary embodiment, the segment inset 120 for the first contact lens 102 is between about 0 to about 2 mm and the segment inset 120 of the second contact lens 104 is between about 0.4 to about 2.5 mm. In another preferred exemplary embodiment, the segment inset 120 for the first contact lens 102 is between about 0.5 to about 1.5 mm and the segment inset 120 of the second contact lens 104 is between about 1 to about 2 mm.

For convenience, the boundaries of the various zones illustrated in Figure 1 are shown as discrete lines; however, one of ordinary skill in the relevant art wilt recognize that the boundaries may be blended by any suitable

CLAIMS

1. A translating contact lens pair for treating presbyopia comprising:

a first contact lens including an optical zone, a peripheral zone and an edge zone and having a first set of optical zone features with a first set of values for the features; and

a second contact lens including an optical zone, a peripheral zone and an edge zone and having a second set of optical zone features with a second set of values for the features, wherein a value of at least one feature in the first set of optical power zone features is different than the value of that feature in the second set of optical power zone features and wherein the optical zone of each contact lens is asymmetric about the vertical meridian of the contact lens wherein the first set of optical zone features comprises a first predetermined power of the lens and the second set of optical zone features comprises a second predetermined power of the lens and wherein the first predetermined power is 100 percent power and the second predetermined power is less than 100 percent power.

2. The translating contact lens pair according to claim 1, wherein the optical zone of each contact lens comprises at least one distance vision subzone lying substantially above a meridian of the contact lens.

3. The translating contact lens pair according to claim 1, wherein the optical zone of each contact lens comprises at least one near vision subzone below a horizontal meridian of the contact lens.

4. The translating contact lens pair according to claim 1, wherein the optical zone of each contact lens comprises at least one intermediate vision subzone.

5. The translating contact lens pair according to claim 1, wherein the peripheral zone of each contact lens includes a pseudotruncation design feature on an anterior surface thereof.

6. The translating contact lens pair according to claim 4, wherein the first set of optical zone features comprises a first predetermined segment height (or vertical distance from the lens center to the closest vertical point of the near or intermediate vision subzone) and the second set of optical zone features comprises a second predetermined segment height.

7. The translating contact lens pair according to claim 6, wherein the first predetermined segment height ranges from 0 to 1.0 mm and the second predetermined segment height ranges from 0.4 to 2.0 mm.

8. The translating contact lens pair according to claim 6, wherein the first predetermined segment height ranges from 0 to 0.6 mm and the second predetermined segment height ranges from 0.6 to 1.5 mm.

9. The translating contact lens pair according to claim 1, wherein the first predetermined power is 100 percent power and the second predetermined power ranges from 25 to 75 percent power.

10. The translating contact lens pair according to claim 1, wherein the first pre-determined power is 100 percent power and the second predetermined power is 50 percent power.

11. A translating contact lens pair for treating presbyopia comprising:

a first contact lens including an optical zone, a peripheral zone and an edge zone and having a first set of optical zone features with a first set of values for the features; and

a second contact lens including an optical zone, a peripheral zone and an edge zone and having a second set of optical zone features with a second set of values for the features, wherein a value of at least one feature in the first set of optical power zone features is different than the value of that feature in the second set of optical power zone features and wherein the optical zone of each contact lens is asymmetric about the vertical meridian of the contact lens wherein the first set of optical zone features comprises a first predetermined power of the lens and the second set of optical zone features comprises a second predetermined power of the lens and wherein the first predetermined power is less than 100 percent power and the second predetermined power is less than 100 percent power, but not equal to the first pre-determined power.

12. The translating contact lens pair according to claim 1, wherein the first set of optical zone features comprises a first predetermined asphericity and the second set of optical zone features comprises a second predetermined asphericity.

13. The translating contact lens pair according to claim 12, wherein the first and second predetermined asphericities have conic constants between +0.5 and –1.0.

14. The translating contact lens pair according to claim 1, wherein the first set of optical zone features comprises a first predetermined shape and the second set of optical zone features comprises a second predetermined shape.

15. The translating contact lens pair according to claim 14, wherein the first and second predetermined shapes are identical.

16. The translating contact lens pair according to claim 14, wherein the first and second predetermined shapes are not identical.

17. The translating contact lens pair according to claim 1, wherein the first set of optical zone features comprises a first predetermined orientation relative to the vertical meridian and the second set of optical zone features comprises a second predetermined orientation relative to the vertical meridian.

18. The translating contact lens pair according to claim 17, wherein the first and second predetermined orientations are identical.

19. The translating contact lens pair according to claim 17, wherein the first and second predetermined orientations are not identical.

20. The translating contact lens pair according to claim 4, wherein the first set of optical zone features comprises a first predetermined inset (or the nasalward horizontal displacement of the geometric center of the near or intermediate vision subzone relative to the lens center) and the second set of optical zone features comprises a second predetermined inset (or the nasalward horizontal displacement of the geometric center of the near or intermediate vision subzone relative to the lens center).

21. The translating contact lens pair according to claim 20, wherein the first predetermined inset ranges from 0 to 2.0 mm and the second predetermined inset ranges from 0.4 to 1.5 mm.

22. The translating contact lens pair according to claim 20, wherein the first predetermined inset ranges from 0.5 to 1.5 mm and the second predetermined inset ranges from 1.0 to 2.0 mm.